

SOLAR FOX

General Instructions

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GENERAL INSTRUCTIONS

FOR

SOLAR FOX

INSTALLATION

1. Unlock and open the coin box door.
2. Remove four (4) "CABINET LEVELING LEGS" from inside the coin box.
3. Tip the cabinet to the side and remove the shipping cleats from its bottom.
 - ° Locate the threaded holes - one in each corner - and install the "CABINET LEVELING LEGS" in them.
 - ° Level the cabinet.
 - ° When finished, the cabinet should be stable in the upright position.
4. Plug the game into a **standard** A.C. wall outlet **ONLY!**

-----**WARNING**-----

Game **MUST** be
properly grounded.

5. The power ON/OFF switch is located:
 - ° UPRIGHT MODEL: On top of the cabinet toward the back.
 - ° MINI MODEL: In the center of the cabinet back just below the rear access door.
 - ° COCKTAIL TABLE MODEL: Underneath the cabinet on Player No. 2's side.

LINE VOLTAGE SAFETY INTERLOCK SWITCHES

Line voltage SAFETY INTERLOCK SWITCHES have been provided for your protection. The locations of these SAFETY INTERLOCK SWITCHES are:

1. UPRIGHT MODEL: Inside the rear of the cabinet on the right side of the rear access door.

2. MINI MODEL: Inside the rear of the cabinet on the right side of the rear access door.
3. COCKTAIL TABEL: Inside the cabinet on the hinge side of the coin door.

When the cabinet access door(s) are secured in place, the SAFETY INTERLOCK SWITCH plunger(s) are in a fully depressed condition. The game circuit can function normally.

When any cabinet access door(s) are opened, the SAFETY INTERLOCK SWITCH plunger(s) are in a partially extended condition. This isolates the game circuit from the line voltage.

To restore power to the game circuit with the access door(s) open, gently pull the SAFETY INTERLOCK SWITCH plunger(s) out to the fully extended condition. THIS IS TO BE USED FOR SERVICING THE GAME ONLY!

SELF-TEST

A slide switch is provided to make the game run a "Self-Test" on itself. The SELF-TEST SWITCH is located just inside the cabinet on the right side of the coin door frame as you face it.

To put the game into the Self-Test mode; turn the game ON and let it warm up for a few minutes. Then slide the SELF-TEST SWITCH to the ON position and actuate the "TILT" switch on the back side of the coin door just below the door lock to obtain the Self-Test-Menue display on the monitor screen.

When in the Self-Test mode, the monitor screen will display the results of certain test functions the game has run on itself. (These will be discussed in more detail later.)

TO SERVICE THE CONTROL PANEL(S)

1. UPRIGHT MODEL:

- ° The control panel is held in place by two latches, one on the left side and one on the right side of the cabinet.

They are spring loaded to provide constant positive pressure on their latch plates.

They can be reached through the coin door AFTER turning power to the game off.

To release the latches, lift up and toward the center of the control panel.

Once they are released, unhook them from their latch plates.

- ° To remove the control panel:

Raise it up and tilt it toward you until you can see the cable behind it.

Cradling the control panel between yourself and the cabinet, disconnect it from its cabling.

The control panel is now free and can be removed.

- ° To reinstall the control panel, reverse this procedure.

2. MINI MODEL:

- ° The control panel is held in place by two latches, one on the left side and one on the right side of the cabinet.

They are spring loaded to provide constant positive pressure on their latch plates.

They can be reached through the coin door **AFTER turning power to the game off.**

To release the latches, lift up and toward the center of the control panel.

Once they are released, unhook them from their latch plates.

- ° To remove the control panel:

Raise it up and tilt it toward you until you can see the cable behind it.

Cradling the control panel between yourself and the cabinet, disconnect it from its cabling.

The control panel is now free and can be removed.

- ° To reinstall the control panel, reverse this procedure.

3. COCKTAIL TABLE MODEL:

- ° Each control panel is held in place by several screws, two on the inside of the cabinet and three along the bottom edge of the control panel.

Turn the power off to the game.

Open the coin box door and release the two latches on the inside of the cabinet up next to the table top.

CAUTION: The right hand latch is very close to the **HIGH VOLTAGE** on the monitor. **BE CAREFUL!!**

Once they're released, unhook them from their latch plates.

Grasp the table top in the center above the coin door lifting up and to the side to tilt it open.

CAUTION: Due to the weight of the monitor, **EXTREME CARE MUST** be taken when opening the cabinet.

Remove the screws which secure the control panel in place.

- ° To remove the control panel(s):

Disconnect it from its cabling.

The control panel is now free and can be removed.

- ° To reinstall the control panel(s), reverse this procedure.

REMOVAL OF THE MAIN-DISPLAY-GLASS AND/OR THE T.V. BEZEL ASSEMBLY

1. UPRIGHT MODEL:

NOTE: In order to do this, the control panel MUST be removed first. See the "UPRIGHT MODEL" procedure.

- ° **Turn the power to the game off** and remove the control panel.
- ° Remove the screws which secure the glass clamping plate.
- ° Lift out the glass clamping plate. This frees the main-display-glass so it can be lifted up.
- ° By putting your finger in the hole in the middle of the main-display-glass support, you can lift it up and out.
- ° Remove the screws which secure the T.V. bezel assembly in place (front and back).
- ° The T.V. bezel assembly is now free and can be slid out of the cabinet.
- ° To reinstall the T.V. bezel assembly and the main-display-glass, reverse this procedure.

2. MINI MODEL:

NOTE: In order to do this, the control panel MUST be removed first. See the "MINI MODEL" procedure.

- ° **Turn the power to the game off** and remove the control panel.
- ° Remove the screws which secure the glass clamping plate.
- ° Lift out the glass clamping plate. This frees the main-display-glass so it can be lifted up.
- ° By putting your finger in the hole in the middle of the main-display-glass support, you can lift it up and out.
- ° Remove the screws which secure the T.V. bezel assembly and lift it out.

NOTE: Use the hole in the center of the main-display-glass support to grasp it.

- ° Reverse this procedure to reinstall the T.V. bezel assembly and the main-display-glass.

3. COCKTAIL TABLE MODEL:

NOTE: This may be done with the table top in the open or the closed position. If you decide to open the table top, **TURN THE POWER TO THE GAME OFF FIRST.**

- ° Remove the screws which secure the table top glass clamps in place.
- ° Remove the table top glass.
- ° Loosen the screws which secure the T.V. bezel-glass-clamps in place.

Move the clamps to the side and the bezel glass may be removed.

Remove the screws which secure the bezel assembly to the table top and the bezel with four bezel-glass-clamps may be removed.

- ° To reinstall the T.V. bezel assembly and the table top glass, reverse this procedure.

VOLUME CONTROL POT

The volume control pot is located just inside the cabinet on the RIGHT side of the coin door frame. For adjustment, it may be reached through the coin door on ALL models.

To make the sounds louder, turn the pot clockwise (→) as you face it.

To make the sounds less loud, turn the pot counterclockwise (←) as you face it.

VOLTAGE CONTROL POTS

The voltage control pots are located on the Linear Power Supply P. C. Board. They are pre-set at the factory and **SHOULD NOT** be tampered with at all **unless** the distributors service department is contacted first.

SELF-TEST

The Self-Test mode is a special mode for checking game play statistics as well as game switches and computer functions. It is the easiest and best way to check for proper operation of the entire game.

NOTE: Putting the game into Self-Test **WILL NOT** cause the game to erase any CREDITS it has in its memory when the Self-Test mode is entered.

You may begin a Self-Test at any time by sliding the Self-Test switch to the "ON" position after the power to the game is on (Self-Test switch located just inside cabinet on right side of coin door frame). When this is done, the game will react as follows:

1. If the game is in the Attract mode when the Self-Test switch is moved to the "ON" posi-

tion, it will finish the sequence and then go into the Self-Test mode. This is illustrated by the display of the Self-Test Mode Menu on the monitor screen.

2. If the game is in the Ready-To-Play mode or the Play mode when the Self-Test switch is slid to the "ON" position, it **WILL NOT** go into the Self-Test mode until **AFTER** the players last Ship has been eliminated (the game **MUST** be over). At this point, the game will go into the Self-Test mode. Again, this is illustrated by the display of the Self-Test Mode Menu on the monitor screen.
3. The fastest way to enter the Self-Test mode is to slide the Self-Test switch to the "ON" position and then activate the "TILT" switch located on the back side of the coin door just below the lock mechanism. The game will then **IMMEDIATELY** go into the Self-Test mode.

The Self-Test mode has eight (8) major categories as illustrated by the following Figure of the Self-Test Mode Menu as it should appear on the monitor screen.

1. It is easy to select what category you want to enter. By pushing the control stick forward or pulling it back, the Arrow at the left of the screen can be moved UP and DOWN, (forward=UP) and (backward=DOWN), until it is in front of the category you want to test. Release the button at this time.
2. After the Arrow has been positioned, depress either "FAST" button on the console and the monitor screen will display the test category you have selected.
 - ° Once you are **IN** one of the Self-Test mode categories, FOLLOW THE **ON-SCREEN INSTRUCTIONS** TO **COMPLETE** THE TEST.
3. The next group of Figures show the **CORRECT** screen presentation for **EACH** category of the Self-Test mode.

The first display of the Self-Test mode is the Self-Test-Mode-Menu. It should look like this:

SELECT DESIRED TEST

- | | |
|---|------------------|
| 1 | SELF DIAGNOSTICS |
| 2 | SOUNDS |
| 3 | PLAYER INPUT |
| 4 | BOOKKEEPING |
| 5 | MACHINE SETUP |
| 6 | CHANNEL TEST |
| 7 | PRESET |
| 8 | GRID DISPLAY |

POSITION CURSOR BY USING
JOY STICK

HIT FAST BUTTON FOR TEST

During the SELF DIAGNOSTICS section of the Self-Test mode, you will first see a cross hatch pattern on the screen for about 1/2 second. Second, you will see a lot of different colored bars shown on the monitor screen. These bars will be UNpainted one at a time from the top down. Third, you will see the screen painted Red, Blue, and Green in bars from the top down. Fourth, all the different colored bars you saw "Second" are displayed again. And fifth, the different colored bars are replaced by this message: **"HIT KICK BUTTON TO EXIT"**.

If the SELF DIAGNOSTICS find one or more bad ROM or RAM chips: instead of going through what is described above, the game will give you a written message as to which parts are bad.

During the SOUNDS section of the Self-Test mode, the game will give a display which looks like the following:

SELECT A SOUND

- 1 ALL SOUNDS
- 2 EXIT
- 3 BONUS SHIP
- 4 YELLOW THRUSTER HIT
- 5 FIREBALL
- 6 TIMER BELLS
- 7 SLOW BELL
- 8 RUBBER RUNOVER
- 9 LUB DUB
- 10 PULZOR RUNOVER
- 11 RACK MUSIC
- 12 PULZOR EXTRA BONUS
- 13 HAMMER
- 14 EXPLOSION
- 15 PULZOR BONUS LONG
- 16 PULZORS ON SCREEN
- 17 COIN SOUND

POSITION CURSOR BY USING
JOY STICK

HIT FAST BUTTON FOR TEST

During the PLAYER INPUT section of the Self-Test mode, the game will give a display which looks like the following:

PLAYER INPUTS

As the Player Input
Switches and Devices
are activated, the Switch
or Device activated is
spelled out in the blank
space at center of screen.

()

ACTIVATE ALL PLAYER INPUT
SWITCHES AND DEVICES

HIT TILT TO EXIT

During the BOOKKEEPING section of the Self-Test mode, the game will give a display which looks like the following:

SELECT A REPORT OR EXIT

CHUTE 1 COINS _____

CHUTE 2 COINS _____

LONGEST GAME _____

SHORTEST GAME _____

HIGHEST SCORE _____

TIME REPORT

SCORE REPORT

EXIT

POSITION CURSOR BY USING
JOY STICK

HIT FAST BUTTON FOR TEST

In the TIME REPORT and SCORE REPORT sections of the BOOKKEEPING mode, the game will give displays which look like the following:

TIME REPORT				SCORE REPORT			
0	TO	30 SEC	_____	LT	7 000 PTS	_____	
30	TO	60 SEC	_____	LT	50 000 PTS	_____	
60	TO	90 SEC	_____	LT	100 000 PTS	_____	
90	TO	120 SEC	_____	LT	200 000 PTS	_____	
120	TO	150 SEC	_____	LT	300 000 PTS	_____	
150	TO	180 SEC	_____	LT	400 000 PTS	_____	
3	TO	4 MIN	_____	LT	600 000 PTS	_____	
4	TO	5 MIN	_____	LT	800 000 PTS	_____	
5	TO	6 MIN	_____	LT	1 000 000 PTS	_____	
OVER		6 MIN	_____	GT	1 000 000 PTS	_____	

HIT FAST BUTTON TO EXIT

HIT FAST BUTTON TO EXIT

In the SCORE REPORT section, the "LT" means "LESS THAN" and the "GT" means "GREATER THAN".

During the SETUP OPTIONS section of the Self-Test mode, the game will give a display which looks like the following:

SETUP OPTIONS

COIN CHUTE 1

* = Factory recommended settings.

*1 COINS FOR

*1 CREDITS

COIN CHUTE 2

*1 COINS FOR

*1 CREDITS

BASE SELECTION

*3 BASES FOR 1 CREDIT

*7 BASES FOR 2 CREDITS

*1 REPLAY LEVELS

*3 TIMER LEVELS

STICK UP AND DOWN MOVES 

JOY STICK LEFT AND RIGHT
CHANGES OPTION VALUES

PRESS FAST BUTTON TO EXIT

The difficulty level of the game is controlled by the "TIMER LEVELS" setting in the SETUP OPTIONS section of the game. The easiest level of play is represented by "1" and the most difficult level of play is represented by "9".

During the CHANNEL TEST section of the Self-Test mode, the game will give a display which looks like the following:

CHANNEL TEST

CHANNEL 1

CHANNEL 2

CHANNEL 3

CHANNEL 4

CHANNEL 5

CHANNEL 6

HIT FAST BUTTON TO EXIT

Once you enter the CHANNEL TEST section of the Self-Test mode, the game automatically tests Channels 1 through 6 giving a tone for each one as it checks it. After the 6th Channel is tested, the game automatically repeats the test until the FAST button is hit. It then goes back to the Self-Test Mode Menu.

During the PRESET section of the Self-Test mode, the game will give a display which looks like the following:

RESET VALUES
MOVE ARROW TO SELECT
RESET OPTIONS

- 1 ALL VALUES
- 2 COIN COUNTERS ONLY
- 3 FACTORY SETTINGS ONLY
- 4 EXIT

POSITION CURSOR BY USING
JOY STICK

HIT FAST BUTTON FOR TEST

During the GRID DISPLAY section of the Self-Test mode, the game shows a white cross hatch pattern on the monitor screen. This is for alignment and/or test purposes. This pattern will remain on the monitor screen until the FAST button is hit. The game will then go back to the Self-Test Mode Menu.

To leave the Self-Test mode, simply slide the Self-Test switch to the "OFF" position at **ANY** time. The game will then run through the ROM/RAM test display after which normal game functions will return to the monitor screen.

S O L A R F O X

O P T I O N S W I T C H S E T T I N G S

/////////////////////////////////SWITCH NO. 1 - AT B 3 - LOCATED ON SOUND I/O P.C. BOARD/////////////////////////////////

	SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8	SW#9	SW#10
PRESS CHANGE SPEED BUTTON TO HALT YOUR SHIP	ON	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED		NOT USED	
PRESS CHANGE SPEED BUTTON TO INCREASE SHIPS SPEED	OFF									
COCKTAIL TABLE UPRIGHT								ON OFF		
FREEZE VIDEO NORMAL OPERATION										ON OFF

/////////////////////////////////SWITCH NO. 3 - AT D 14 - LOCATED ON SOUND I/O P.C. BOARD/////////////////////////////////

	SW#1	*SW#2	*SW#3	*SW#4
NORMAL OPERATION SOUND I/O DIAGNOSTIC MODE	OFF ON			
NORMAL OPERATION RAM/ROM TEST INDICATES TEST RESULTS VIA YELLOW L E D ON SOUND I/O BOARD: FAST FLASH = BAD ROM SLOW FLASH = BAD RAM		OFF ON		
NORMAL OPERATION OSCILLATOR TEST			OFF ON	
NORMAL OPERATION FILTER TEST				OFF ON

* NO EFFECT IF SW#1 OF SWITCH NO. 3 IS IN THE "OFF" POSITION.

THE REMAINDER OF SOLAR FOX'S MOST COMMON OPTION SETTINGS ARE CONDUCTED DURING THE
MACHINE SETUP PORTION OF THE SELF-TEST MODE. SIMPLY FOLLOW THE ON-SCREEN
INSTRUCTIONS TO MAKE ANY ADJUSTMENTS YOU FEEL ARE NECESSARY.

M C R II S Y S T E M

P. C. B O A R D J U M P E R O P T I O N S

V I D E O G E N E R A T O R P. C. B O A R D

MANUFACTURER	EPROM NO.	JW#1	JW#2	JW#3	JW#4	JW#5	JW#6	JW#7	JW#8
MOTOROLA	68764		*	*		*	*	*	*
	68766		*	*		*	*	*	*
INTEL	2764	*			*		*	*	
T. I.	2564		*	*		*			*

C. P. U. P. C. B O A R D

MANUFACTURER	EPROM NO.	JW#1	JW#2	JW#3	JW#4	JW#5	JW#6	NOTE: JUMPER OP- TION FOR PROGRAM ROMs ONLY.
NUMEROUS MFR'S	2532	*		*	*		*	
NUMEROUS MFR'S	2732	*		*	*	*		

S O U N D I / O P. C. B O A R D

MANUFACTURER	EPROM NO.	JW#1	JW#2
NUMEROUS MFR'S	2532	*	
NUMEROUS MFR'S	2732		*

* = CUT JUMPER WIRES WHERE THIS SYMBOL "*" APPEARS.

The above table illustrates the fact that the Video Generator P.C. Board used in the MCR II System has 8 jumper wires, the C.P.U. P.C. Board used in the MCR II System has 6 jumper wires, and the Sound I/O P.C. Board used in the MCR II System has 2 jumper wires.

All of the above Boards can be used with a variety of different **SETS of EPROM chips**. However, these EPROMS are not all made by the same manufacturer and do have some internal differences. So, in order to make them function properly in their respective P.C. Boards, certain jumper wires on these Boards have to be cut.

The above table tells you which jumpers to cut (depending on which EPROM set you're going to use) by showing a "*" under that jumper wires number. If there is **NO "*" under a jumper wires number, THAT PARTICULAR JUMPER WIRE IS NOT TO BE CUT.**

V Technical Troubleshooting

Troubleshooting

Introduction

The most common problems occur in harness components such as the coin acceptor, player controls, interconnecting wiring, etc. The TV monitor and PCB computer cause their share of problems too, but not as much as the harness and its component parts. TV monitor troubleshooting will not be covered here because it is covered in that section of this manual.

As you already know, the PCB computer is a complex device with a number of different circuits. Some circuits remain basically the same among games, but overall there are a great many differences between them. PCB troubleshooting procedures, therefore, can be lengthy and will differ greatly among games. However, some basic Z-80 CPU information is involved in this section.

General Suggestions

The first step in any troubleshooting procedure is correctly identifying the malfunction's symptoms. This includes not only the circuits or features malfunctioning, but also those still operational. A carefully trained eye will pick up other clues as well. For instance, a game in which the computer functions fail completely just after money was collected may have a quarter shorting the PCB traces. Often, an experienced troubleshooter will be able to spot the cause of the problem even before opening the cabinet.

After all the clues are carefully considered, the possible malfunctioning areas can be narrowed down to one or two good suspects. Those areas can be examined by a process of elimination until the cause of the malfunction is discovered.

Harness Component Troubleshooting

Typical problems falling in this category are coin and credit problems, power problems and failure of individual features.

NO GAME CREDIT

For example, your prospective player inserts his quarter and is not awarded a game. The first item to check is if the quarter is returned. If the quarter is returned, the malfunction most certainly lies in the coin acceptor itself. First, use a set of test coins (both old and new) to ascertain that the player's coin is not undersize or underweight. If your test coins are also returned, coin acceptor servicing is indicated. Generally, the cause of this particular problem is a maladjusted magnet gate. Normally, this will mean slightly closing the magnet gate a little by turning the adjusting screw out a bit (see section on coin acceptor for more details).

If the quarter is not returned and there is no game credit, the cause of the malfunction may be in one of several areas. First try operating the coin return button; if the coin is returned, the problem is most likely in the magnet gate. Enlarge the gap according to the coin acceptor service procedures. If this does not cure the problem, remove the coin acceptor, clean it and perform the major adjustment procedure.

If the trapped coin is not returned when the wiper lever is actuated, you may have an acceptor jammed by a slug, gummed up with beer, a jammed coin chute, or mechanical failure of the acceptor mechanism. In this case, first check for the slug that will generally be trapped against the magnet. If so, simply remove the slug and test the acceptor. If the chute is blocked, remove the acceptor and remove the jammed coins. If there is actual failure of the acceptor, remove the unit and repair as indicated in the coin acceptor service procedures.

If the coin is making its way through the acceptor (that is, falling into the coin box), yet there is still no game credit, you either have a mechanical failure of the coin switch or electrical failure of the coin and credit circuits. The first place to begin is by checking the coin switch. Most of these switches are the make/break variety of micro switch, which is checked by testing for continuity between the NO, NC, and C terminals. When not actuated, the NC and C terminals should be continuous and the NO terminal open. When operated, the NO and C terminals should close and the NC should be open. If the coin switch checks out, examine the connections to the terminals to make sure there is good contact. If necessary, use the continuity tester and check from the terminal lug on the switch to the associated PCB trace. This will tell you if there is a continuous line all the way to the credit circuit.

If the coin switch wires do not check out, the problem is in the computer — most likely in the coin and credit circuitry.

If you do get game credit when a coin is deposited, but the game will not start when the start switch is pressed, you may have a problem in the start switch, the interconnecting wiring or in the computer. First check the switch. If the switch is OK, proceed to check the wiring. Again, make sure you go from the terminal lug on the switch to the PCB trace. This way, you will check the terminal contact as well as PCB edge connector contact. If the wiring is continuous, proceed to check the PCB credit circuit. If not, check each section of the wiring, until the discontinuity is located. If the wiring is OK, the problem must lie in the computer.

Transformer and Line Voltage Problems

Your machine must have the correct line voltage to operate properly. If the line voltage drops too low, a circuit in the computer will disable game credit. The point at which the computer will fail to work will vary some from game to game, but no game will work on line voltage that drops below 105 VAC.

Low line voltage may have many causes. Line voltage normally fluctuates a certain amount during the day as the total usage varies. Peak usage times occur mainly at dawn or dusk, so if your machine's malfunction seems to be related to the time of day, this may be a factor. A large load connected to the same line as the game (such as a large air conditioner or other device with an exceptionally large motor) may drop the line voltage significantly when starting up. This drop can result in an intermittent credit problem. In addition, poor connections in the location wiring, plug, or line cord may also cause a significant drop in power. Cold solder joints in the game's harness, especially in areas like the transformer connections, interlock switch, or fuse block, may also produce the same results, although probably on a more permanent basis.

Sometimes location owners (especially in bars) replace light switches with dimmer rheostats, and the game is sometimes on the same line. Obviously, the voltage available to the game is going to drop dramatically when the dimmer is turned.

In any case, the way to check for correct line voltage is with your VOM. Set the VOM to 250 VAC and stick the probes in the wall receptacle. If it's OK here, check the transformer primary connections. If you do not get 117 VAC, examine the solder joints on the transformer, fuse block, and interlock switch. If you do get 117 VAC, the problem must be either in the transformer, harness connections, or in the PCB power supply.

If you suspect the transformer, check its secondaries with the VOM set to 50 VAC and correlate the readings with the legend on the side of the transformer. The transformer must also be correctly grounded, so check the ground potential as well, especially if there is a hum bar rolling up or down the TV screen.

HARNESS PROBLEMS

Other harness problems include blowing fuses and malfunctioning controls. The repeating blown-fuse problem can sometimes be quite exasperating to solve, for short circuits have the tendency to occur in areas almost impossible to find. First, try inserting a new fuse, as old fuses age and blow without cause. If the new one also blows, you definitely have a short.

The best way to approach this problem is by turning the power off and disconnecting devices that may be causing the problem, such as the TV, transformer, and PCB. Disconnect the devices by pulling off their connectors, but do not allow them to touch. If necessary, insulate them with small pieces of electrical tape. Then, connect your VOM across the terminals of the fuse block (all electrical power shut off), and set it to one of the resistance scales. This will save blowing a fuse each time you want to check the circuit.

If the VOM reveals that disconnecting the devices removed the short, reconnect the devices one by one until the short returns. The last device connected is the one that is at fault. If the VOM reads a short even after the devices are disconnected, the fault must lie in the harness itself, and only patient exploration will reveal its location. First, carefully examine all the wiring, looking for terminals that may be touching, metal objects such as coins shorting connections or burned insulation. If necessary, use the VOM to check each suspected wire.

MALFUNCTIONING CONTROLS

One of the most common problems here is a bad potentiometer. Typically, a bad pot will cause the image to jump as it reaches a certain point. The only cure for this one is to install a new pot.

If a feature that is operated by a switch (for example, joysticks, foot pedals, control panel buttons) does not operate at all, check the switch with a VOM or continuity tester to verify its operation. If the switch does not check out, replace it. If the switch is OK, you should suspect the input to the switch from the PCB. In this case, get out the harness and logic schematics and check to see what kind of input it is. In many cases, the input will be +5 VDC. If so, use the VOM to check its presence. Normally, the switch is used to pull a +5 VDC line LOW to GND or to pull a LOW line HIGH. If the PCB output is missing, check the wire length from the PCB. If you find the signal at the PCB trace, the wire length or connection is at fault. If not, begin exploring the PCB using the logic schematics.

A Glossary of Microprocessor Terms

MICROPROCESSOR — one or several microcircuits that perform the function of a computer's CPU. Sections of the circuit have arithmetic and comparative functions that perform computations and executive instructions.

CPU — central-processing unit. A computing system's "brain", whose arithmetic, control and logic elements direct functions and perform computations. The microprocessor section of a microcomputer is on one chip or several chips.

PROM — programmable read-only memory. User permanently sets binary on-off bits in each cell by selectively fusing or not fusing electrical links. Nonerasable. Used for low-volume applications.

EPROM — erasable, programmable, read-only memory. Can be erased by ultraviolet light bath, then reprogrammed. Frequently used during design and

development to get programs debugged, then replaced by ROM for mass production.

ROM — read-only memory. The program, or binary on-off bit pattern, is set into ROM during manufacture, usually as part of the last metal layer put onto the chip. Nonerasable. Typical ROM's contain up to 16,000 bits of data to serve as the microprocessor's basic instructions.

RAM — random-access memory. Stores binary bits as electrical charges in transistor memory cells. Can be read or modified through the CPU. Stores input instructions and results. Erased when power is turned off.

LSI — large scale integration. Formation of hundreds or thousands of so-called gate circuits on semiconductor chips. Very large scale integration (VLS) involves microcircuits with the greatest component density.

MOS — metal-oxide semiconductor. A layered construction technique for integrated circuits that achieves high component densities. Variations in MOS chip structures create circuits with speed and low-power requirements, or other advantages (static will damage a MOS chip).

Introduction to the Z-80 CPU

The term "microcomputer" has been used to describe virtually every type of small computing device designed within the last few years. This term has been applied to everything from simple "microprogrammed" controllers constructed out of TTL MSI up to low end minicomputers with a portion of the CPU constructed out of TTL LSI "bit slices." However, the major impact of the LSI technology within the last few years has been with MOS LSI. With this technology, it is possible to fabricate complete and very powerful computer systems with only a few MOS LSI components.

The Zilog Z-80 family of components can be configured with any type of standard semiconductor memory to generate computer systems with an extremely wide range of capabilities. For example, as few as two LSI circuits and three standard TTL MSI packages can be combined to form a simple controller. With additional memory and I/O devices a computer can be constructed with capabilities that only a minicomputer could previously deliver.

New products using the MOS LSI microcomputer are being developed at an extraordinary rate. The Zilog Z-80 component set has been designed to fit into this market through the following factors:

1. The Z-80 is fully software compatible with the popular 8080A CPU.
2. Existing designs can be easily converted to include the Z-80.
3. The Z-80 component set is at present superior in both software and hardware capabilities to any other microcomputer system on the market today.
4. For increased throughput the Z80A operating at a 4 MHz clock rate offers the user significant speed advantages.

Microcomputer systems are extremely simple to construct using Z-80 components. Any such system consists of three parts:

1. **CPU (Central Processing Unit)**
2. **Memory**
3. **Interface Circuits to peripheral devices**

The CPU is the heart of the system. Its function is to obtain instructions from the memory and perform the desired operations. The memory is used to contain instructions and in most cases data that is to be processed. For example, a typical instruction sequence may be to read data from a specific peripheral device, store it in a location in memory, check the parity and write it out to another peripheral device. Note that the Zilog component set includes the CPU and various general purpose I/O device controllers, while a wide range of memory devices may be used from any source. Thus, all required components can be connected together in a very simple manner with virtually no other external logic.

General Purpose Registers

There are two matched sets of general purpose registers, each set containing six 8-bit registers that may be used individually as 8-bit registers or as 16-bit register pairs by the programmer. One set is called BC, DE and HL while the complementary set is called BC', DE' and HL'. At any one time the programmer can select either set of registers to work with through a single exchange command for the entire set. In systems where fast interrupt response is required, one set of general purpose registers and an accumulator/flag register may be reserved for handling this very fast routine. Only a simple exchange command need be executed to go between the routines. This greatly reduces interrupt service time by eliminating the requirement for saving and retrieving register contents in the external stack during interrupt or subroutine processing. These general purpose registers are used for a wide range of applications by the programmer. They also simplify programming, especially in ROM based systems where little external read/write memory is available.

Arithmetic & Logic Unit (ALU)

The 8-bit arithmetic and logical instructions of the CPU are executed in the ALU. Internally the ALU communicates with the registers and the external

data bus on the internal data bus. The type of functions performed by the ALU include:

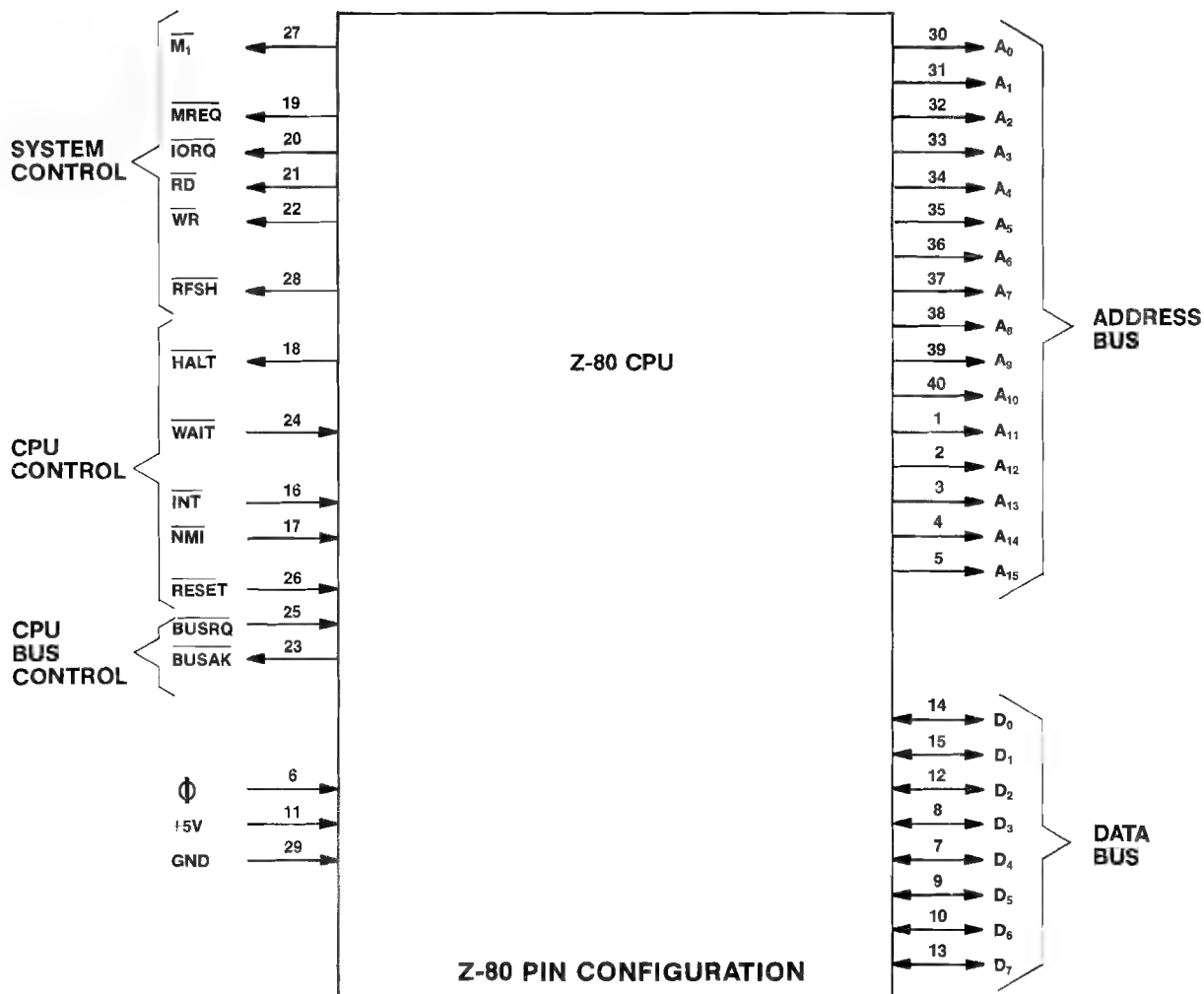
Add	Left or right shifts or rotates (arithmetic and logical)
Subtract	Increment
Logical AND	Decrement
Logical OR	Set bit
Logical Exclusive OR	Reset bit
Compare	Test bit

Instruction Register and CPU Control

As each instruction is fetched from memory, it is placed in the instruction register and decoded. The control sections performs this function and then generates and supplies all of the control signals necessary to read or write data from or to the registers, control the ALU and provide all required external control signals.

Z-80 CPU Pin Description

The Z-80 CPU is packaged in an industry standard 40 pin Dual In-Line Package. The I/O pins are shown in the below figure and the function of each is described.



A₀-A₁₅**(Address Bus)**

Tri-state output, active high. A₀-A₁₅ constitute a 16-bit address bus. The address bus provides the address for memory (up to 64K bytes) data exchanges and for I/O device data exchanges. I/O addressing uses the 8 lower address bits to allow the user to directly select up to 256 input or 256 output ports. A₀ is the least significant address bit. During refresh time, the lower 7 bits contain a valid refresh address.

D₀-D₇**(Data Bus)**

Tri-state input/output, active high. D₀-D₇ constitute an 8-bit bidirectional data bus. The data bus is used for data exchanges with memory and I/O devices.

M₁**(Machine Cycle one)**

Output, active low. $\overline{M_1}$ indicates that the current machine cycle is the OP code fetch cycle of an instruction execution. Note that during execution of 2-byte op-codes, $\overline{M_1}$ is generated as each op code byte is fetched. These two byte op-codes always begin with CBH, DDH, EDH or FDH. $\overline{M_1}$ also occurs with \overline{IORQ} to indicate an interrupt acknowledge cycle.

MREQ**(Memory Request)**

Tri-state output, active low. The memory request signal indicates that the address bus holds a valid address for a memory read or memory write operation.

IORQ**(Input/Output Request)**

Tri-state output, active low. The \overline{IORQ} signal indicates that the lower half of the address bus holds a valid I/O address for a I/O read or write operation. An \overline{IORQ} signal is also generated with an $\overline{M_1}$ signal when an interrupt is being acknowledged to indicate that an interrupt response vector can be placed on the data bus. Interrupt Acknowledge operations occur during M₁ time while I/O operations never occur during M₁ time.

RD**(Memory Read)**

Tri-state output, active low. \overline{RD} indicates that the CPU wants to read data from memory or an I/O device. The addressed I/O device or memory should use this signal to gate data onto the CPU data bus.

WR**(Memory Write)**

Tri-state output, active low. \overline{WR} indicates that the CPU data bus holds valid data to be stored in the addressed memory or I/O device.

RFSH**(Refresh)**

Output, active low. \overline{RFSH} indicates that the lower 7 bits of the address bus contain a refresh address for dynamic memories and the current MREQ signal should be used to do a refresh read to all dynamic memories.

HALT**(Halt state)**

Output, active low. \overline{HALT} indicates that the CPU has executed a HALT software instruction and is awaiting either a non maskable or a maskable interrupt (with the mask enabled) before operation can resume. While halted, the CPU executes NOP's to maintain memory refresh activity.

WAIT**(Wait)**

Input, active low. \overline{WAIT} indicates to the Z-80 CPU that the addressed memory or I/O devices are not ready for a data transfer. The CPU continues to enter wait states for as long as this signal is active. This signal allows memory or I/O devices of any speed to be synchronized to the CPU.

INT**(Interrupt Request)**

Input, active low. The Interrupt Request signal is generated by I/O devices. A request will be honored at the end of the current instruction if the internal software controlled interrupt enable flip-flop (IFF) is enabled and if the \overline{BUSRQ} signal is not active. When the CPU accepts the interrupt, an acknowledge signal (\overline{IORQ} during M₁ time) is sent out at the beginning of the next instruction cycle. The CPU can respond to an interrupt in three different modes that are described in detail in section 5.4 (CPU Control Instructions).

NMI**(Non-Maskable Interrupt)**

Input, negative edge triggered. The non maskable interrupt request line has a higher priority than \overline{INT} and is always recognized at the end of the current instruction, independent of the status of the interrupt enable flip-flop. \overline{NMI} automatically forces the Z-80 CPU to restart to location 0066H. The program counter is automatically saved in the external stack so that the user can return to the program that was interrupted. Note that continuous \overline{WAIT} cycles can prevent the current instruction from ending, and that a \overline{BUSRQ} will override a \overline{NMI} .

RESET

Input, active low. RESET forces the program counter to zero and initializes the CPU. The CPU initialization includes:

- 1) Disable the interrupt enable flip-flop

- 2) Set Register I = 00_H
- 3) Set Register R = 00_H
- 4) Set Interrupt Mode 0

During reset time, the address bus and data bus go to a high impedance state and all control output signals go to the inactive state.

BUSRQ

(Bus Request)

Input, active low. The bus request signal is used to request the CPU address bus, data bus and tri-state output control signals to go to a high impedance state so that other devices can control these buses. When BUSRQ is activated, the CPU will set these

buses to a high impedance state as soon as the current CPU machine cycle is terminated.

BUSAK

(Bus Acknowledge)

Output, active low. Bus acknowledge is used to indicate to the requesting device that the CPU address bus, data bus and tri-state control bus signals have been set to their high impedance state and the external device can now control these signals.

CLK

(Clock)

Single phase TTL level clock which requires only a 330 ohm pull-up resistor to +5 volts to meet all clock requirements.

PLEASE NOTE:

THE INFORMATION CONTAINED IN THIS SECTION
IS TOLD IN AN EASY TO UNDERSTAND MANNER
AND IS INTENDED TO AID THOSE WITHOUT AN
ELECTRONICS DEGREE IN TROUBLESHOOTING AND
REPAIRING THEIR GAMES T.V. MONITOR.

IF YOU READ THROUGH THIS SECTION AND STILL
HAVE QUESTIONS, PLEASE CONTACT YOUR DISTRIBUTOR
OR MIDWAY MANUFACTURING COMPANY AT THE TOLL
FREE NUMBER PROVIDED WITH YOUR GAMES PAPERS.

**OUR STAFF AND OUR DISTRIBUTORS STAND READY
TO HELP YOU!**

THANK YOU

VI T.V. Monitor

Color T.V. Monitor

Introduction: (How to use this section of your manual.)

This section has been designed to simply familiarize you with one of the more mystical components in your game — the T.V. monitor. If you are an electronics technician who is quite knowledgeable on the subject, you may decide to just go to the schematics and start troubleshooting the defective monitor. But if you are like most people, a monitor is a T.V. set, and that means a complex doo-dad that means big buck repairs. This isn't necessarily so. This section of the manual will acquaint you with the monitor and could just help you repair it if you feel adventurous enough to give it a try. If you have any knowledge of electronics, especially the use of a voltmeter, the repairs you can make are astonishing. Just keep in mind that **ELECTRICITY CAN BE VERY DANGEROUS, SO BE CAREFUL!!**

If you want to understand how a monitor works, just read the "THEORY OF OPERATION" subsection. If you wish, you can follow along with the schematics. The information is presented in a very basic manner but more complete treatment of the subject can be found in the technical sections of bookstores.

If you want to attempt to repair your monitor, it would be a good idea to read this whole section beginning to end before starting. **Pay attention to all warnings**

and take them seriously. The more equipment you have the better, but a low cost Volt-Ohm-Milliameter can often do the trick. Here are the steps to take:

1. Find the symptom that matches the problems your monitor has in the "SYSTEM — DIAGNOSIS" subsection. The diagnosis tells the circuit or area the problem may be in and possibly even the actual component causing it.
2. Once you have the circuit that is causing the trouble, read the "TROUBLESHOOTING" subsection to learn the procedure for finding the bad part.
3. Next, go to the schematic section and find the schematic that matches your monitor. It may be helpful to read the "DIFFERENCES BETWEEN MONITORS" subsection if you are unsure of which monitor you have. Use the schematic to see what parts are in the offending circuit.

That really is all there is to it. Just remember that there are some bizarre or rare symptoms not covered, or that a monitor may have two or more different problems that only a genius, the experienced, or an experienced genius can figure out. But be patient, follow safety precautions, and remember that there is also literature available from the monitor companies through your distributor or from Midway Manufacturing Company on request. (There is a toll free number on the back side of the front cover of this manual.)

Symptom Diagnosis

1. Insufficient width or height:

- A. Horizontal line (due to VERTICAL CIRCUIT DEFECT).
 - Bad yoke.
 - Bad vertical output section.
 - Open fusible resistor in vertical section.
 - Bad height control.
 - Bad flyback.
- B. Vertical line (due to HORIZONTAL CIRCUIT DEFECT).
 - Bad yoke.
 - Open width coil.
 - Open part in horizontal output section.

2. Picture spread out too far or crushed in certain areas:

- A. Horizontal or vertical output transistor.
- B. Bad component in output circuitry.

3. Line too close with black spacing:

- A. Problem in vertical section causing poor linearity.

4. Poor focus and convergence:

- A. Bad high voltage transformer ("flyback") or control.
- B. Focus voltage wire not connected to neck-board terminal.

5. Colors missing; check:

- A. Interface color transistors.
- B. Color output transistors.
- C. Cracked printed circuit board.
- D. Color circuits.
- E. Video input jack.

6. Picture not bright enough:

- A. Weak emission from picture tube. (Turn horizontal sync off frequency and put brightness all the way up for about 15 minutes. Occasionally this cures the problem.)

7. Silvery effect in white areas; check:

- A. Beam current transistors.
- B. Weak picture tube emission.

8. Too much brightness with retrace lines; check:

- A. Beam limiter transistors.
- B. Brightness and/or color blanking control set too high.

9. Increasing brightness causes an increase in size and poor focus.

- A. Weak high voltage rectifier or regulation (high voltage unit).

10. Small picture and/or poor focus:

- A. Low B+ voltage (power supply trouble).

11. Vertical rolling:

- A. Vertical oscillator transistor, IC, or circuit.
- B. No sync from logic board.

12. Horizontal line across center:

- A. Vertical output circuit is dead (see symptom No. 1. A.).
- B. Vertical oscillator is not putting out the right wave form.

13. Picture bends:

- A. Horizontal sync needs adjusting.
- B. Magnetic or electromagnetic interference.

14. Flashing picture, visible retrace lines:

- A. Broken neck board.
- B. Internal short circuit in the picture tube (arcing).

15. Unsymmetrical picture or sides of picture:

- A. Defective yoke.

16. No brightness, power supply operating — No high voltage for the picture tube; check:

- A. Horizontal oscillator.
- B. Horizontal amplifier and output.
- C. Flyback transformer (high voltage unit).

17. No brightness, high voltage present; check:

- A. Heater voltage to the tube at the neck board.
- B. Screen-grid voltage for the tube.
- C. Focus voltage.
- D. Grid to cathode picture tube bias.

18. No high voltage; check:

- A. For AC input to the "flyback".
- B. Horizontal deflection stages.
- C. Flyback transformer.
- D. Yoke.
- E. Power supply.

19. No horizontal and vertical hold; check:

- A. Sync transistors and circuit.
- B. Wires and jack from logic board to the monitor.

20. Wavy picture — (power supply defect); check:

- A. Transistors, diodes, electrolytic capacitors in the power supply.

21. Moving bars in picture:

- A. Ground connector off between monitor and logic boards.
- B. Defect in the power supply (see wavy picture symptom).

22. Washed out picture (see picture not bright enough):

- A. Check video signal at the cathode pins with an oscilloscope. If there is about 80 volts peak to peak, the picture tube has weak emission.

23. Monitor won't turn on:

- A. Problem in the power supply: Check fuse, transistors, open fusible resistor.
- B. Shorted horizontal output transistor.

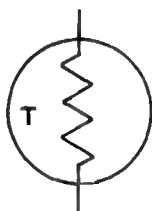
C. Defective high voltage disabling circuit.

D. Crack(s) somewhere on main chassis board.

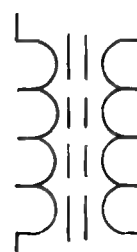
24. Can't adjust purity or convergence:

- A. Use a degausser to demagnetize the picture tube carefully following your degausser's instructions.
- B. Picture tube defective.
- C. Metal foreign material is in picture tube shield.
- D. Nearby equipment is electromagnetically interfering.
- E. The poles of the earth are pulling off the purity.
- F. Poor focus or width of picture.

Guide To Schematic Symbols



THERMISTOR
(POLARITY DOESN'T MATTER)



IRON CORE TRANSFORMER
(SUCH AS A FLYBACK)



INDUCTOR, COIL, CHOK
(POLARITY DOESN'T MATTER)



FUSE
(POLARITY DOESN'T MATTER)



ZENER DIODE

(-) CATHODE

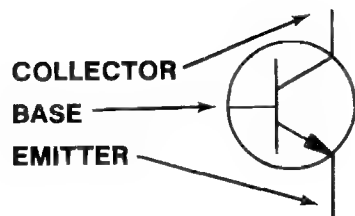
(+) ANODE

CATHODE (-)

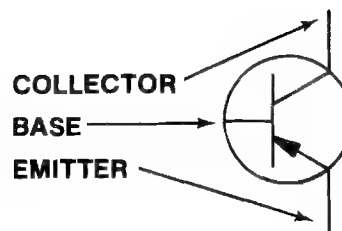
ANODE (+)



DIODE



NPN TRANSISTOR



PNP TRANSISTOR



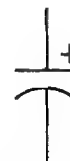
VARIABLE RESISTOR, POT, CONTROL
(POLARITY DOESN'T MATTER)



RESISTOR
(POLARITY DOESN'T MATTER)



LINES ARE CONNECTED



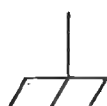
ELECTROLYTIC CAPACITOR



LINES ARE NOT CONNECTED



CAPACITOR
(POLARITY DOESN'T MATTER)



OR



GROUND

Troubleshooting

Troubleshooting monitors requires experience, patience, **and luck**. The first step is to match the symptom the monitor displays to the diagnosis next to it in the "SYMPTOM-DIAGNOSIS" subsection. This will pinpoint the circuit the problem is probably in, and often the parts to check. Next, the circuit should be visually inspected to see if there are any parts broken, burned, or if something is there that shouldn't be, like a loose screw, etc. Some parts go bad before others and should be checked first. In fact, following is the general order in which parts usually go bad:

1. Semiconductors (like transistors, diodes, and integrated circuits).
2. Fusible resistors.
3. Electrolytic capacitors.
4. Resistors.
5. Capacitors and coils.

Always remember that a monitor can bite like a snake. Even when it is turned off, capacitors hold voltage and will discharge it to you should you be touching chassis ground. The picture tube or CRT, itself, is a giant capacitor, so avoid the flyback anode plug hole. With the monitor on, the power supply circuit and/or the flyback, which puts out at least 18,000 volts, **CAN BE KILLERS!!** Avoid handling power transistors (usually output transistors), yoke terminals, and other high power components when the monitor is on.

WARNING: That picture tube is a bomb!

When it breaks, first it implodes, then it explodes. Large pieces of glass have been known to fly in excess of 20 feet in all directions. **DO NOT** carry it by the long, thin neck. Discharge its voltage to ground by shorting the anode hole to ground. Use a plastic handled screwdriver, connect one end of a wire with an alligator clip at each end to chassis ground and the other end to the metal shaft of the screwdriver. Using **ONE HAND ONLY** (put the other in your pocket) and touching **ONLY** the plastic handle of the screwdriver (**DO NOT TOUCH THE METAL SHAFT**) stick the blade of the screwdriver into the anode hole. Be prepared for a fairly loud pop and a flash. The longer the monitor has been turned off, the smaller the pop and dimmer the flash. But **BE CAREFUL**, picture tubes will hold a very

healthy charge for at least **a week** if not longer. Even after you've discharged it once, it may still carry a residual charge. It's better to be too careful than dead, which is why electronic equipment always carries stickers referring servicing to qualified personnel. Handle the side with the viewing screen against your chest when changing it. **ALWAYS** wear safety goggles when handling the picture tube.

To maintain the safety and performance of the monitor, always use exact replacement parts. For instance, the wrong components in the power supply can cause a fire, or the wrong color transistor may give a funny color to the picture. Service your monitor on a nonconductive firm table like wood, **NOT METAL**, and take off all of your jewelry just in case. With all this in mind, you are ready to begin troubleshooting.

Observe the picture carefully. Try to vary the appropriate control that would most likely affect your particular symptom. For example, if there is poor brightness or no picture, try turning up the brightness or contrast control. If the controls have no effect at all, chances are there is trouble with the control itself, the circuit it controls, or a nearby circuit that may be upsetting voltages. Go to the list of symptoms and determine with the schematic where the bad circuit is.

CAUTION:

Keep in mind that capacitors hold a charge as can the picture tube (for at least a week and usually longer), and could shock you.

First, check for obvious visual defects such as broken or frayed wires, solder where it is not supposed to be, missing components, burned components, or cracked printed circuit boards. If everything looks good up to this point, make sure that diodes, electrolytic capacitors, and transistors have their leads connected in the right polarity as shown on the schematic and the circuit board.

Turn on the power and measure the voltages at the leads of the active devices such as tubes, transistors, or integrated circuits. Any voltage that does not come within at least 10% to 15% of the voltage specified on the schematic indicates either a problem with that device or a component connected with it in the circuit. The next step is to use the ohmmeter to narrow down the field of possible offenders.

To test a transistor, one lead of the ohmmeter is placed on the base; and the other lead placed just on the emitter, then on the collector. A normal transistor will read either high resistance (infinite), or little resistance (400 to 900 ohms), depending on the polarity of this type transistor. Then the leads should be switched, one remaining on the base, and the other switched from the emitter to the collector. Now the opposite condition should result: the resistance should be infinite if it was lower when the other lead was on the base. Consistently infinite readings indicate an open, and a short is demonstrated by 0-30 ohms on most of these test readings. Finally, place one lead on the collector, then the other on the emitter. No matter which lead is used, there should be infinite resistance. Any lower reading, such as 50 ohms (which is typical on a bad transistor), indicates a short.

This all sounds pretty confusing, but a little experience on a good transistor will make you an expert in no time. Usually, the lowest ohmmeter setting is used for testing transistors. Once in a great while a transistor may check out good on this test, but may actually be "leaky" or break down only on higher voltages. If in doubt, change it. It is also wise to check the transistor out of the circuit just in case some component in the circuit is affecting the ohmmeter reading.

A diode is tested like a transistor except it only has two leads. Again, there should be high resistance one

way and little resistance the other. If it tests bad, take one lead out of the circuit in case some component is messing up the ohmmeter reading.

NOTE: DO NOT leave soldering equipment on the leads too long since all semiconductors, especially integrated circuits, are easily destroyed by heat.

Without special equipment, integrated circuits are checked by verifying the proper DC voltage on the pins and the correct AC wave form using an oscilloscope. **BE CAREFUL:** Shorting their pins can easily destroy them.

Resistors are checked with an ohmmeter and should usually be within ten percent of the value stated on them and on the schematic. You may have to desolder one lead from the printed circuit board. If you wreck the foil on the board, carefully solder a small wire over the break to reconnect the conductive foil.

Capacitors are tricky. Their resistance goes up when checked with an ohmmeter which shows a charging action. As they suck up current from the meter, the voltage goes up and so does the resistance. If you are sure a particular circuit is giving you a problem and everything else checks out O.K., Electrolytic capacitors are prime suspects. Substitute a new one and keep your fingers crossed.

Theory of Operation

To understand what goes on inside the monitor, large general groups of circuits will be examined instead of laboriously analyzing the branches and small circuits that make up these groups. This will help avoid confusion and aid in a basic, concrete, knowledge of what makes up a monitor.

THE POWER SUPPLY —

The AC going to the monitor from the game transformer is just like the voltage and current from your wall outlet. It jumps up and down going positive and negative sixty times a second. But a monitor needs nice, smooth DC; direct current, not alternating. So diodes chop up the AC and a big electrolytic capacitor filters it out to make it even smoother. Since the monitor is a big piece of electronic equipment, with many circuits demanding a lot of power from the power supply, there are also zener diodes and transistors to help maintain a nice, constant, smooth voltage so that the monitor circuits don't jump around. And this is what happens when you see a wavy picture. There is AC creeping

through the power supply, so it must be malfunctioning. If the voltage from the power supply is too low, the other circuits will be starved for power and you may see a small, wavy picture, or none at all.

Some circuits receive voltages that are higher than what the power supply should put out. But they come from the flyback transformer which will be discussed later.

THE INTERFACE SECTION OF THE CHASSIS —

The interface section of the chassis is fairly easy to identify. It is right by the place where the video jack(s) from the logic board(s) plug into. There are sets of transistors that receive the separate red, green, blue, and sync information from the cables that come from the logic boards. The circuits jack up the voltage and match impedances, or in other words, prepare the logic board outputs for the circuits that will really amplify them for the output devices such as the yoke in the case of the sync, or the picture tube that shows the colors.

An interesting aside is that our sync is composite negative sync. That means two things:

1. The sync is a negative going wave form.
2. There are two pulses going at different speeds over the same wire:
 - a. Vertical wave forms at 60 times per second (or Hertz) and
 - b. Horizontal wave forms at about 15,750 times per second (Hz).

The sync is amplified by a sync amplifier transistor and sent on its way to the oscillators. The sync or timing information will be explained along with the oscillator shortly.

The color information is sent via wires to the neck board where the main amplification occurs. This will also be discussed later.

VERTICAL AND HORIZONTAL DEFLECTION —

After the sync signal is amplified by the sync amp, it goes to two different sections, the vertical and horizontal circuits. Basically, the sync signals are for timing so the picture doesn't mess up since it is assembled like an orderly jigsaw puzzle, but so fast that you can't see the electron beams for each color painting the picture on the screen. This will all become clear soon. For now, we will follow the 60 cycle component of the sync as it goes on its journey to the deflection yoke.

The 60 cycle pulse goes to the vertical oscillator to make sure this circuit goes back and forth (or oscillates) at 60 times a second. Without this pulse keeping the circuit at the correct speed, it may get lazy and oscillate at 58 cycles or lower, or get ambitious and oscillate at 62 cycles or higher. At the wrong speed, the picture will start to roll up or down.

A Wells Gardner 13" or 19" color monitor uses transistors for its sync section. An Electrohome 13" or 19" color monitor uses an integrated circuit IC501 for its sync section. The idea is all the same. The output to the vertical amplifying transistors for all monitors must be a sawtooth wave form, sort of like a bunch of pyramids, racing to the yoke's vertical coils at 60 times a second.

Along the way to the output transistors, the 60 cycle pulse is shaped and amplified to do the job: the yoke magnetically pushes the electron beam to fill the screen out sideways looking at the screen with the greatest length going up and down. Or viewing the screen sitting like a home television set. The amplified vertical output fills the screen up and down. Watching a monitor like this, seeing only a horizontal line means a problem with the vertical coils of the yoke or anything from the vertical output section on back to the oscillator.

The horizontal section is very similar with a few exceptions. The horizontal wave shape is more like a square and has a frequency of 15,750 cycles a second. Again, Wells Gardner uses transistors for the horizontal oscillator, and Electrohome uses the other side of IC501. Still, the effect is the same. If the oscillator isn't going at the correct speed, the picture may move sideways, start to slant, or tear up with slanted thin figures. With both the vertical and horizontal of all monitors, there are variable resistors that change the speed of the oscillators up and down. This way you have controls that can make the correct frequencies to keep the electronic jigsaw puzzle nicely locked in place. If you're driving in a car and next to you someone else is driving their car at exactly the same speed, it will appear that they are not moving. And this is why the sync frequency and the oscillators frequencies must match, so the picture doesn't appear to move.

The correct wave form is shaped and amplified in the circuitry just like in the vertical section. But the horizontal output transistor is a large power transistor and not only serves to give current to the horizontal yoke windings, it also feeds the flyback transformer.

THE FLYBACK TRANSFORMER (OR HIGH VOLTAGE UNIT) —

The picture tube needs high voltage to light up, and the power supply can't meet this demand. The flyback transformer receives current alternating at about 15,750 times per second from the horizontal output transistor. The "flyback" jacks up its input voltage and puts out a higher voltage alternating at the same speed. But, in your "flyback" there are diodes that chop up the alternating voltage to make it a smooth DC output just like in the power supply. This is what goes through that thick red wire to your picture tube. **THIS AREA HAS ABOUT 18,000 VOLTS ON IT AND IT CAN KILL YOU!!**

The "flyback" may be dangerous, but it is also generous. It has extra output windings which give voltage to the heater pins of the picture tube, voltage for the vertical deflection circuits, and picture tube screen-grid voltage. So in a way, the high voltage "flyback" is like a second power supply.

COLOR CIRCUITS

The color circuits are pretty straight forward. The signals go into the interface section where some amplification and impedance matching occurs. These circuits are pretty sparse and simple. Each color just has two transistors and a diode with some resistors and capacitors. From here, the AC color signal is sent by wires to the neck board.

The color output circuits are on the neck board. The color signals going to the transistors are controlled by two variable resistors called drive controls. There only two, one for the red and one for the green. The

blue doesn't have one. In the emitter part of each transistor is another variable resistor that is the cut off control. These controls vary the amount of amplified AC signal that goes to the cathodes of the picture tube. The more signal, the more color. The bases of each of these transistors are connected together and are all connected to the blanking and beam limiting transistors which are in the interface section.

The beam limiter helps control the brightness level, and the blanking transistor rapidly turns the picture tube on and off so that retrace lines don't show up on the screen. By turning up the brightness on a good monitor, these four to six retrace lines can be seen slanting diagonally across the picture.

PROTECTION CIRCUIT —

To protect the high voltage section against voltages that are too high coming from the power supply which could cause X-rays to be emitted from the "flyback", a circuit senses the higher power supply voltage, and using a transistor, turns off the horizontal oscillator. Since the horizontal oscillator doesn't work, the horizontal output transistor has nothing to feed the "flyback" which in turn has nothing to feed the picture tube. The monitor will be silent, have no picture, and will appear to be off. **But don't be fooled.** There is still that excessive amount of voltage coming from the power supply. To find out, check the emitter on TR502 of the Wells Gardner monitors; or the emitter of X04 for the Electrohome monitor. Here are the voltages you should receive:

Wells Gardner = 127VDC
Electrohome = 120VDC

The best place to measure this voltage on an Electrohome monitor is at a pin marked B1 on the chassis. This is because a 13 inch color Electrohome

monitor, the G07-FB0 or G07-902, has an integrated circuit and very little else in the power supply. Still, there should be 120VDC at B1.

THE PICTURE TUBE (OR CRT) —

The picture tube or CRT is an output device. In other words, the end result of the circuits work is displayed by this part. Actually, the output of other circuits is in the neck of the picture tube.

First, there is the heater. The heater boils off electrons from the cathodes so that they (the electrons) shoot up to the screen to excite the phosphors so that the three phosphors emit three colors of light.

The cathodes are next, and again they emit electrons to turn on the tube phosphors, making it glow. The cathode can arc or short to the heater resulting in no picture and a defective picture tube.

Next come the grids. The first grid is grounded. The following grid is the screen grid which receives about 300VDC depending on the brightness setting. The next grid closest to the picture tube screen is the focus grid which gets about one fifth the amount of voltage that is applied to the picture tube anode.

After jetting from the cathode through all these grids, the electrons speed through a mask, a sheet of material with tiny holes, and then excite the tiny dots of phosphor in the inside surface of the picture tube screen. The green electron gun (or cathode and circuitry) spits out electrons which head for the green phosphors only. The same goes for the red and blue guns. The way the phosphor light blends determines the color seen. Should these electron beams become too intense, they may burn the phosphor. With the monitor off, this can be seen as a dark permanent image of the video information on the tube screen.

Differences Between Monitors

The easiest way to identify the brand of monitor you are working with, assuming you can't find the brand name written on it anywhere, is to see if there are two circuit boards rising up from the chassis toward the picture tube neck. In other words, they stand up, or are perpendicular to the chassis, with a black plastic bracket holding them in place. This is a description of a Wells Gardner monitor. They use separate boards for main chunks of circuitry. Therefore, you have a "power board" (the power supply), an "interface board" (the interface section), and a "horizontal/vertical board" (for the deflection circuitry). Still, there are a few parts on the chassis, but most can be found on the board. An Electrohome monitor has no

separate boards, except for the neck board, and just has a flat chassis.

Another good way to determine which monitor you have is to check the transistor call out numbers that are printed on the chassis next to the part. For instance, on the neck board, one of the color output transistors is TR401. If you look through the schematics or the parts lists, you will find TR401 in the Wells Gardner literature. On the other hand, the neck board transistor may say X101. X101 can be found in the Electrohome literature. So, all Wells Gardner transistor call outs begin with TR, and Electrohome transistor call outs start with an "X".

Parts Interchangeability

Some parts can be interchanged on all of the monitors. Here are the rules:

1. You **CAN** swap the voltage regulator TR502 or X01 on any Wells Gardner or Electrohome 19 inch monitor. You **CAN NOT** swap the voltage regulator on the 13 inch Wells Gardner or Electrohome (G07-902) since the Electrohome uses an integrated circuit for the power supply.
2. You **CAN** swap any resistor between monitors that has the same resistance, wattage rating, and tolerance.
3. You **CAN** swap any capacitor between monitors that has the same capacitance, and voltage rating.
4. **PICTURE TUBES:**
Due to the fact that "ELECTROHOME" is now (October, 1981) using a picture tube with an **internal shield**, these picture tubes can be used in EITHER "WELLS GARDNER" or "ELECTROHOME" monitors.

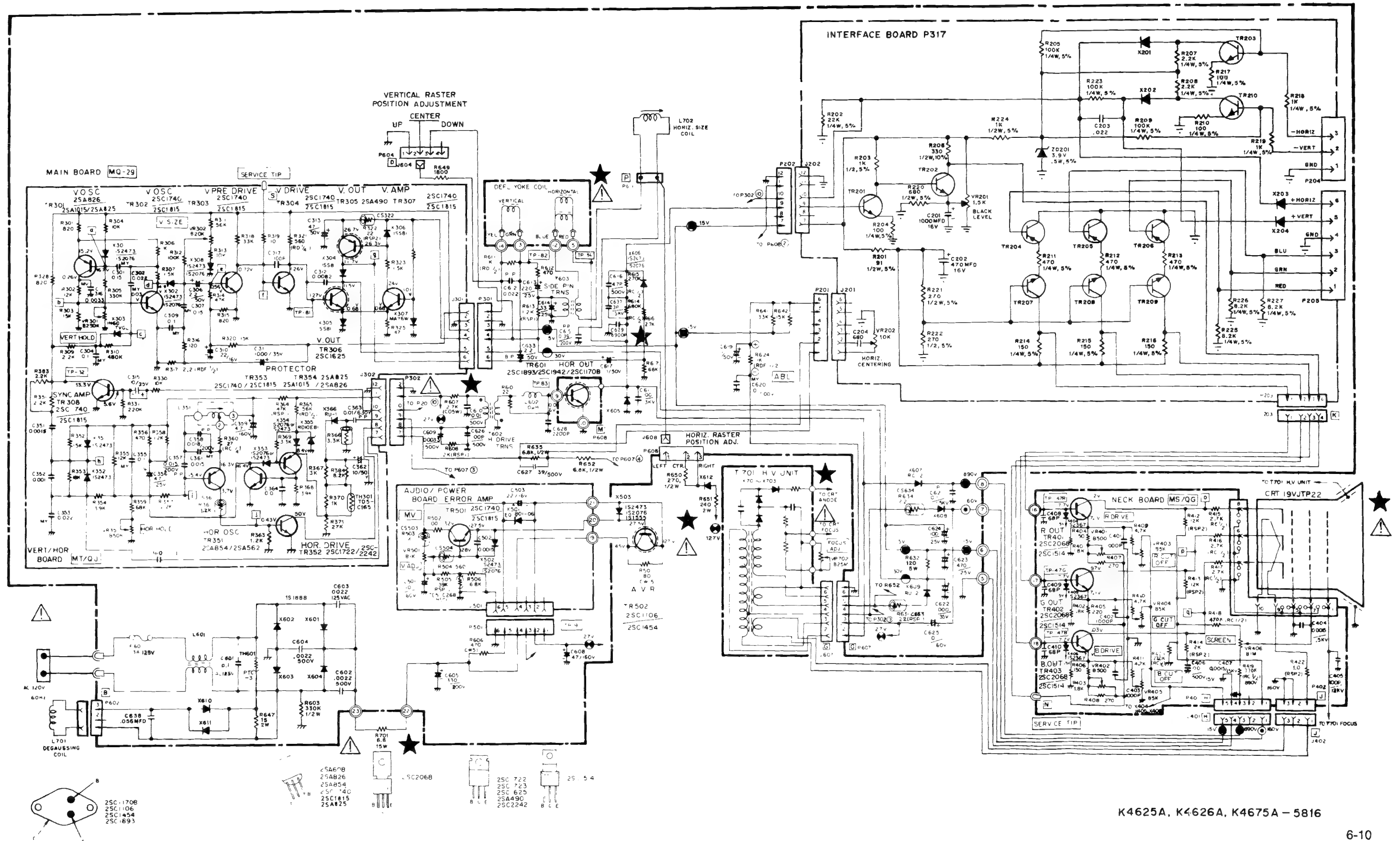
However, a "WELLS GARDNER" picture tube can **ONLY** be used in a "WELLS GARDNER" monitor. It will not function properly if installed in an "ELECTROHOME" monitor. The picture purity will be off.

5. You **CAN NOT** change any part that is a **safety part**, one that is shaded in gray on the schematic; it **MUST** be **IDENTICAL** to the original. **To do otherwise IS DANGEROUS.** For instance, the 13 inch Electrohome (G07-904) monitor "flyback", looks identical to the 19 inch Electrohome (G07-904) monitor "flyback". In fact, there is even a 19 inch Electrohome (G07-905) monitor (which is an obsolete model) with a similar looking "flyback". **NONE OF THESE ARE INTERCHANGEABLE!!**
6. You **CAN** change any of the parts between the G07-904 and G07-907. They're essentially the same monitor except that the G07-907 has a vertically mounted picture tube.

If there is any doubt about what parts can be swapped between each manufacturer's 19 inch and 13 inch models, compare the manufacturer's part number between each one. If they match up, they are the same part.

WELLS-GARDNER 19" COLOR MONITOR SCHEMATIC DIAGRAM

M051-00087-A012



VERT/HOR BOARD (MT/QJ)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
RESISTORS			CAPACITORS (CONT.)		
R301	203X6500-628	820 Ohm, ± 5%, 1/8W Carbon	C313	203X0025-087	47 uF, 50V Electrolytic
R302	203X6500-902	12k Ohm, ± 5%, 1/8W Carbon	C315	203X0015-082	10 uF, 25V Electrolytic
R303	203X6500-927	15k Ohm, ± 5%, 1/8W Carbon	C316	203X1100-220	3300 uF, 50V, ± 10% Mylar
R304	203X6500-886	10k Ohm, ± 5%, 1/8W Carbon	C317	202X8000-616	100 pF, 50V, ± 10% Ceramic
R305	203X6501-241	330k Ohm, ± 5%, 1/8W Carbon	C351	202X7000-281	1500 pF, 50V, ± 10% Ceramic
R306	203X6500-645	1k Ohm, ± 5%, 1/8W Carbon	C352	202X7000-247	1000 pF, 50V, ± 10% Ceramic
R307	203X6500-689	1.5k Ohm, ± 5%, 1/8W Carbon	C353	203X1100-573	0.022 uF, 50V, ± 10% Mylar
R309	203X6500-724	2.2k Ohm, ± 5%, 1/8W Carbon	C355	203X1100-858	0.1 uF, 50V, ± 10% Mylar
R310	203X6501-285	470k Ohm, ± 5%, 1/8W Carbon	C356	203X0015-105	4.7 uF, 25V Electrolytic
R311	203X6501-065	56k Ohm, ± 5%, 1/8W Carbon	C357	203X1201-013	0.015uF, 200V ± 10% PP
R312	203X6501-126	100k Ohm, ± 5%, 1/8W Carbon	C358	203X1201-034	0.018 uF, 200V, ± 10% PP
R313	203X6001-326	10k Ohm, ± 5%, 1/8W Carbon	C359	203X0040-013	4.7 uF, 160V Electrolytic
R314	203X6501-044	47k Ohm, ± 5%, 1/8W Carbon	C360	202X7000-482	0.01 uF, 50V, ± 10% Ceramic
R315	203X6500-628	820 Ohm, ± 5%, 1/8W Carbon	C361	203X1100-509	0.015 uF, 50V, ± 10% Mylar
R316	203X6500-420	120 Ohm, ± 5%, 1/8W Carbon	C362	203X0025-058	10 uF, 50V Electrolytic
R317	203X6206-441	2.2 Ohm, ± 5%, 1/2W Carbon	C363	203X1205-487	0.01 uF, 630V, ± 10% PP
R319	203X6500-169	100 Ohm, ± 5%, 1/8W Carbon	C364	202X7000-482	0.01 uF, 50V, ± 10% Ceramic
R320	203X6500-927	15k Ohm, ± 5%, 1/8W Carbon	SEMICONDUCTORS		
R321	203X6700-509	560 Ohm, ± 5%, 1/2W Carbon			
R322	203X9100-121	22 Ohm, ± 5%, 2W M.O.			
R323	203X6500-689	1.5K Ohm, ± 5%, 1/8W Carbon	TR301	200X4082-614	Transistor, 2SA826Q
R324	203X6500-988	27k Ohm, ± 5%, 1/8W Carbon	TR302	200X3174-006	Transistor, 2SC1740Q
R325	203X6500-326	47 Ohm, ± 5%, 1/8W Carbon	TR303	200X3174-006	Transistor, 2SA1740Q
R328	203X6500-628	820 Ohm, ± 5%, 1/8W Carbon	TR304	200X3174-006	Transistor, 2SC1740Q
R330	203X6500-886	10k Ohm, ± 5%, 1/8W Carbon	TR305	200X4049-081	Transistor, 2SA490YLBGLI
R331	203X6501-209	220k Ohm, ± 5%, 1/8W Carbon	TR306	200X3162-538	Transistor, 2SC1625YLBGLI
R351	203X6500-724	2.2k Ohm, ± 5%, 1/8W Carbon	TR307	200X3174-014	Transistor, 2SC1740R
R352	203X6500-927	15k Ohm, ± 5%, 1/8W Carbon	TR308	200X3174-006	Transistor, 2SC1740Q
R353	203X6500-944	18k Ohm, ± 5%, 1/8W Carbon	TR351	200X4085-415	Transistor, 2SA854Q
R354	203X6500-783	3.9k Ohm, ± 5%, 1/8W Carbon	TR352	200X3172-208	Transistor, 2SC1722BKS
R355	203X6500-902	12k Ohm, ± 5%, 1/8W Carbon	TR353	200X3174-006	Transistor, 2SC1740Q
R356	203X6500-561	470 Ohm, ± 5%, 1/8W Carbon	TR354	200X4082-614	Transistor, 2SA826Q
R357	203X6500-724	2.2k Ohm, ± 5%, 1/8W Carbon	X301	201X2010-144	Diode, (SI) IS2473-T72
R358	203X6500-666	1.2k Ohm, ± 5%, 1/8W Carbon	X302	201X2010-144	Diode, (SI) IS2473-T72
R359	203X6501-088	68k Ohm, ± 5%, 1/8W Carbon	X303	200X8000-026	Diode, (GE), IN60TVGL
R360	203X5500-471	27 Ohm, ± 5%, 1/4W Comp.	X304	200X8010-165	Diode (SI) ISS81
R361	203X6000-998	1.2k Ohm, ± 5%, 1/8W Carbon	X305	201X2010-165	Diode (SI) ISS81
R363	203X6500-666	1.2k Ohm, ± 5%, 1/8W Carbon	X306	201X2010-165	Diode (SI) ISS81
R364	203X9014-988	47k Ohm, ± 5%, 1W M.O.	X307	200X8010-102	Diode (SI) MA26W
R365	203X6700-989	56k Ohm, ± 5%, 1/2W Carbon	X308	200X8010-094	Diode (SI) IS2473
R366	203X6001-148	3.3k Ohm, ± 5%, 1/8W Carbon	X351	201X2010-144	Diode (SI) IS2473-T72
R367	340X2222-734	2.2k Ohm, ± 5%, 1/2W Carbon	X352	201X2010-144	Diode (SI) IS2473-T72
R368	203X6500-785	3.9k Ohm, ± 5%, 1/8W Carbon	X353	201X2010-144	Diode (SI) IS2473-T72
R369	203X6500-762	3.3k Ohm, ± 5%, 1/4W Carbon	X354	201X2010-144	Diode (SI) IS2473-T72
R370	302X6100-961	1k Ohm, ± 5%, 1/4W Carbon	X355	200X8220-851	Diode (Zener) RD10EBI
R371	203X6104-751	2.7k Ohm, ± 5%, 1/4W Carbon	X366	200X8100-130	Diode (HS) RU-1 0.3 US
VR301	204X2122-093	Varistor, 250K Ohm, Vert. Hold	MISCELLANEOUS		
VR302	204X2114-065	Varistor, 20K Ohm, Vert. Size			
VR351	204X2114-059	Varistor, 50K Ohm, Hor. Hold			

CAPACITORS

C301	203X1100-928	0.15 uF, 50V, ± 10% Mylar
C302	203X1100-573	0.022 uF, 50V, ± 10% Mylar
C304	203X1100-858	0.1 uF, 50V, ± 10% Mylar
C306	203X0025-026	2.2 uF, 50V, Electrolytic
C307	203X1100-928	0.15 uF, 50V, ± 10% Mylar
C309	203X1100-858	0.1 uF, 50V, ± 10% Mylar
C310	203X0010-011	22 uF, 16V Electrolytic
C311	203X0020-099	1000 uF, 35V Electrolytic
C312	202X7000-469	0.0082 uF, 50V, ± 10% Ceramic

POWER BOARD (MV)

RESISTORS

R501	204X1725-052	180 Ohm, ± 10%, 15W WW
R502	203X6000-608	100 Ohm, ± 5%, 1/8W Carbon
R503	203X6000-960	1k Ohm, ± 5%, 1/8W Carbon
R504	203X6000-879	560 Ohm, ± 5%, 1/8W Carbon
R505	203X9014-965	39k Ohm, ± 5%, 1W M.O.
R506	203X6500-842	6.8k Ohm, ± 5%, 1/8W Carbon
R551	203X6500-420	120 Ohm, ± 5%, 1/8W Carbon
VR501	204X2050-001	Varistor Vert. Adj.

CAPACITORS

C501	203X0040-020	10 uF, 160V Electrolytic
C502	202X7000-281	1500 pF, 50V, ± 10% Ceramic

J301	204X9300-958	Socket, 6 Pin
J302	204X9300-958	Socket, 6 Pin
P301	204X9601-195	Plug, 6 Pin
P302	204X9601-195	Plug, 6 Pin
TH301	201X0000-534	Thermistor

TRANSFORMERS & COILS

L351	201X5200-091	Coll, Horiz. Osc.
C503	203X0010-011	22 uF, 16V Electrolytic
C551	203X0005-046	220 uF, 10V Electrolytic

SEMICONDUCTORS

TR501	200X3174-006	Transistor, 2SC1740Q
★ TR502	200X3145-404	Transistor, 2SC1454
TR551	200X3172-305	Transistor, 2SC1723
X501	201X2230-042	Diode, (SI) Zener EQB01-06V
X502	201X2010-144	Diode, (SI) IS2473-T72

MISCELLANEOUS

J501	204X9300-958	Socket, 6 Pin
P501	204X9601-195	Plug, 6 Pin
TH501	201X0000-618	Thermistor

NECK BOARD (MS/QG)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
RESISTORS			SEMICONDUCTORS		
R401	203X6500-709	1.8k Ohm ± 5% 1/8W Carbon	C403	202X7000-247	1000 pF, 50V, 10% Ceramic
R402	203X6500-709	1.8k Ohm ± 5% 1/8W Carbon	C404	202X7110-019	1500 pF, 2kV ± 10% Ceramic
R403	203X6500-709	1.8k Ohm ± 5% 1/8W Carbon	C405	202X7150-018	100 pF, 12kV, ± 10% Ceramic
R404	203X6500-447	150 Ohm ± 5% 1/8W Carbon	C406	202X7050-483	.01 uF, 500V, ± 10% Ceramic
R405	203X6500-481	220 Ohm ± 5% 1/8W Carbon	C407	202X7110-019	1500 pF, 2kV ± 10% Ceramic
R406	203X6500-447	150 Ohm ± 5% 1/8W Carbon	C408	202X8000-550	68 pF, 50V, ± 10% Ceramic
R407	203X6500-508	270 Ohm ± 5% 1/8W Carbon	C409	202X8000-550	68 pF, 50V, ± 10% Ceramic
R408	203X6500-508	270 Ohm ± 5% 1/8W Carbon	C410	202X8000-550	68 pF, 50V, ± 10% Ceramic
R409	203X6500-800	4.7k Ohm ± 5% 1/8W Carbon	SEMICONDUCTORS		
R410	203X6500-800	4.7k Ohm ± 5% 1/8W Carbon			
R411	203X6500-800	4.7k Ohm ± 5% 1/8W Carbon			
R412	203X9104-809	12k Ohm ± 5% 2.0W Metal Oxide			
R413	203X9104-809	12k Ohm ± 5% 2.0W Metal Oxide			
R414	203X9104-809	12k Ohm ± 5% 2.0W Metal Oxide			
R415	203X5601-313	2.7k Ohm ± 10% 1/2W Comp.	TR401	200X3206-800	Transistor, 2SC2068, 2SC1514 (R output)
R416	203X5601-313	2.7k Ohm ± 10% 1/2W Comp.			
R417	203X5601-313	2.7k Ohm ± 10% 1/2W Comp.	TR402	200X3206-800	Transistor, 2SC2068, 2SC1514 (G output)
R418	203X5602-254	470k Ohm ± 10% 1/2W Comp.			
R419	203X5602-185	330k Ohm ± 10% 1/2W Comp.	TR403	200X3206-800	Transistor, 2SC2068, 2SC1514 (B output)
R422	203X9105-117	1.0 Ohm ± 10% 2W Metal Oxide			
R423	203X5102-155	270k Ohm ± 5% 1/4W Carbon			
VR401	204X2115-014	500 Ohm Varistor R Drive	X404	201X2100-126	Diode, IS2367 (protector)
VR402	204X2115-014	500 Ohm Varistor B Drive	X405	201X2100-126	Diode, IS2367 (protector)
VR403	204X2115-006	5k Ohm Varistor R Cutoff	X406	201X2100-126	Diode, IS2367 (protector)
VR404	204X2115-006	5k Ohm Varistor G Cutoff			
VR405	204X2115-006	5k Ohm Varistor B Cutoff			
VR406	204X2000-025	1M Ohm Varistor Screen			

CAPACITORS

C401	202X7000-247	1000 pF, 50V, 10% Ceramic
C402	202X7000-247	1000 pF, 50V, 10% Ceramic

★ 297X2000-072 HIGH VOLTAGE ASSEMBLY (T701)

★ R701	204X1625-058	3.3 Ohm, ± 10% 10W WW Resistor
VR702	204X3901-125	Focus Control
X701		Diode (SI HV) } Part of T701
X702		Diode (SI HV) }
X703		Diode (SI HV) }

FINAL ASSEMBLY PARTS

★ 88X-0129-506	19VJTP22 Plx Tube
38A5554-000	Assy. Purity Shld/Degaussing
205X9800-256	Lateral/Purity Assembly
★ 202X1110-810	Yoke, Deflection
208X2000-946	CRT Socket
297X2000-072	HV Unit (T701)
6A0397	Plug, Line Cord
9A2753-003	Degaussing Coil (L701)

INTERFACE BOARD (P305)

(MODEL 19K4606)

RESISTORS

R201	340X3910-934	91 Ohm, 5%, 1/2W Carbon
R203	340X3102-934	1k Ohm, 5%, 1/2W Carbon
R204	340X2101-934	100 Ohm, 5%, 1/4W Carbon
R206	340X3331-944	330 Ohm, 10%, 1/2W Carbon
R207	340X3102-934	1k Ohm, 5%, 1/2W Carbon
R208	340X3152-934	1.5k Ohm, 5%, 1/4W Carbon
R209	340X2101-934	100 Ohm, 5%, 1/4W Carbon
R210	340X3102-934	1k Ohm, 5%, 1/2W Carbon
R211	340X2331-934	330 Ohm, 5%, 1/4W Carbon
R212	340X2331-934	330 Ohm, 5%, 1/4W Carbon
R213	340X2331-934	330 Ohm, 5%, 1/4W Carbon
R214	340X2201-934	200 Ohm, 5%, 1/4W Carbon
R215	340X2201-934	200 Ohm, 5%, 1/4W Carbon
R216	340X2201-934	200 Ohm, 5%, 1/4W Carbon
VR201	40X0590-017	1.5k Ohm, Black Level Control

CAPACITORS

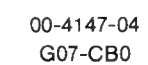
C201	45X0524-038	1000 uF, 16V Electrolytic
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SEMICONDUCTORS

TR201	86X0121-001	Transistor (NPN)
TR202	86X0121-001	Transistor (NPN)
TR203	86X0121-001	Transistor (NPN)
TR204	86X0066-001	Transistor (PNP)
TR205	86X0066-001	Transistor (PNP)
TR206	86X0066-001	Transistor (PNP)
TR207	86X0121-001	Transistor (NNP)
TR208	86X0121-001	Transistor (NPN)
TR209	86X0121-001	Transistor (NPN)
ZD201	66X0040-018	Diode, Zener, 6.8v, 5%, 0.5W
ZD202	66X0040-019	Diode, Zener, 3.9v, 5%, 0.5W

MISCELLANEOUS

J201	204X9300-958	Socket, 6 Pin
J202	204X9300-958	Socket, 6 Pin
J203	206X5019-207	Socket, 4 Pin
P201	204X9601-195	Plug, 6 Pin
P202	204X9601-195	Plug, 6 Pin
P203	204X9600-845	Plug, 4 Pin
P205	6A0393-006	Plug, 6 Pin



REPLACEMENT PARTS LIST - ELECTROHOME 19'' MONITOR

Components identified by the ⚠ symbol in the PARTS LIST and on the Schematic have special characteristics important to safety.

DO NOT degrade the safety of the set through improper servicing.

Abbreviations for Resistors and Capacitors

Resistor		Capacitor	
C R	: Carbon Resistor	C Cap.	: Ceramic Capacitor
Comp. R	: Composition Resistor	M Cap	: Mylar Capacitor
OM R	: Oxide Metal Film Resistor	E Cap.	: Electrolytic Capacitor
V R	: Variable Resistor	BP E Cap.	: Bi-Polar (or Non-Polar) Electrolytic Capacitor
MF R	: Metal Film Resistor	MM Cap.	: Metalized Mylar Capacitor
CMF R	: Coating Metal Film Resistor	PP Cap.	: Polypropylene Capacitor
UNF R	: Nonflammable Resistor	MPP Cap.	: Metalized PP Capacitor
F R	: Fusible Resistor	PS Cap	: Polystyrol Capacitor
		Tan. Cap.	: Tantal Capacitor

NOTE: When ordering replacement parts please specify the part number as shown in this list including part name, and model number. Complete information will help expedite the order.

Use of substitute replacement parts which do not have the same safety characteristics as specified, may create shock, fire or other hazards. For maximum reliability and performance, all parts should be replaced by those having identical specifications.

SERVICE REPLACEMENT PARTS LIST

Symbol	Description	Part Number
	Main P.C.B. Ass'y	SU-1133A
	CRT Socket P.C.B. Ass'y	SU-3032A
	Purity Shield Ass'y	07-220083-03

Outside of the P.C.B. Ass'y

Symbol	Description	Part Number
⚠	Picture Tube 19"	17-7198-03
⚠	Deflection Yoke	A29779-D = 21-141-01
⚠	PC Magnet	A75034-B = 29-32-01
⚠	Flyback Transf.	A29951-B
⚠	HVR	A46600-A
R05	UNF Resistor 220 Ω, 25W K	QRF258K-221
C04	C Capacitor 150pF, AC1.5KV	QCZ0101-005
X01	Si. Transistor	2SD870
X02	Si. Transistor	2SC1106A
SC	Screw #8-3/8	31-610818-06
SC	Screw 1/4 x 3/4 Pix Tube Mtg. (4)	31-601418-12
WA	Pyramidal Lock Washer (4)	33-255-01
	Nut Retainer, Pix Tube Mtg. (4)	33-494-01
	Clip — P.C.B. Support	33-629-02
	Standoff	33-670-010R-02
	Wire Terminal (Gnd. Strap)	34-228-03
	Terminal Lug (Gnd.)	34-33-04
	Groundstrap Assy.	34-574-02
	Grounding Spring	35-212-03
	Wire Hook (Gnd. Strap)	35-3053-02
	Purity Shield Holddown Clamp	35-2348-01
	Support Brkt. RH	35-3890-01
	Support Brkt. LH	35-3890-02
	Chassis Base	38-449-02
	Yoke Wedge (3)	39-1233-01

Purity Shield Ass'y. Parts List

Symbol	Description	Part Number
D911, D912	Degaussing Coil	21-1007-30
	Rectifier 1 Amp 600V (2)	28-22-27
	Pin Terminal (2)	34-708-01
	Pin Terminal Housing	34-709-01
	Purity Shield (2 pcs.)	35-3847-01
	Purity Shield (2 pcs.)	35-3847-02
C911	Capacitor 100nF 10% 400V	48-171544-62
R921	Resistor, Wirewound 33 Ω, 4W	42-113301-03
	Fire Retardent Term. Strip 4 Lug	34-492-09

CRT Socket P.C.B. Ass'y (SU-3032A) Parts List

Resistors		Part Number
Symbol	Description	
R3105	V R 200	QVZ3234-022
R3106	V R 200	QVZ3234-022
R3113	V R 5K	QVZ3234-053
R3114	V R 5K	QVZ3234-053
R3115	V R 5K	QVZ3234-053
R3116	OM R 10K Ω 2W J	QVZ3234-053
R3117	OM R 10K Ω 2W J	QRG029J-103
R3118	OM R 10K Ω 2W J	QRG029J-103
R3119	OM R 10K Ω 2W J	QRG029J-103
R3120	Comp. R 3.3K Ω 1/2W K	QRZ0039-332
C3121	Comp. R 3.3K Ω 1/2W K	QRZ0039-332
	Comp. R 3.3K Ω 1/2W K	QRZ0039-332

Capacitors		Part Number
Symbol	Description	
C3107	E Cap. 10uF 250V A	QEW53EA-106
C3108	C Cap. 1000pF DC1400V P	QCZ9001-102M

Coils		Part Number
Symbol	Description	
L3101	Peaking Coil	QQL043K-101

Semiconductors**Symbol**

X3101
X3102
X3103

Description

Si. Transistor
Si. Transistor
Si. Transistor

Part Number

2SC1514VC
2SC1514VC
2SC1514VC

Miscellaneous**Symbol**

△

Description

△CRT Socket

Part Number

A76068

Main PCB Ass'y (SU-1133A) Parts List**Resistors****Symbol**

R1406
R1408
R1410
R1414
R1415
R1421
R1422
△FR1401
△R1503
R1504
R1509
R1512
R1514
R1515
R1522
R1523
R1528
R1534
VR1501
△R1703
△R1704
△R1901
R1902
R1903
R1904
R1905
△Q1908
△R1909
R1910
△FR1901

Description

V R 200Ω
V R 200Ω
CMF R 6.8Ω1W J
OM R 3.3KΩ1W J
OM R 2.7KΩ1W J
OM R 12KΩ2W J
V R 10KΩ
△F R 68Ω2W K
△CMF R 11.8KΩ ¼W +1%
V R 5KΩ
OM R 10KΩ2W J
OM R 8.2KΩ2W J
OM R 820Ω2W J
CMF R 8.2Ω1W J
CMF R 4.7Ω1W J
OM R 68Ω2W J
OM R 390Ω1W J
ZN R
ZN R
△CMF R 39Ω½W +1%
△CMF R 7.68KΩ ¼W +1%
△Posistor
UNF R 2Ω7W K
CMF R 4.7Ω3W J
OM R 10KΩ2W J
OM R 18KΩ1W J
△CMF R 47Ω½W +1%
V R 2KΩ
△CMF R 2.74KΩ ¼W +1%
△F R 220Ω½W K

Part Number

QVZ3230-002
QVZ3230-002
QRX019J-6R8
QRG019J-332
QRG019J-272
QRG026J-123Z
QVZ3230-014
QRH024K-680M
QVR142F-1182
QVZ3230-053
QRG026J-103Z
QRG026J-822Z
QRG026J-821Z
QRX019J-8R2
QRX019J-4R7
QRG026J-680Z
QRG019J-391
ERZ-C05ZK471
ERZ-C05DK271
QVR122F-3902
QVR142F-7681
A75414
QRF076K-2R0
QRX039J-4R7
QRG026J-103Z
QRG019J-183
QVR122F-470Z
QVP5A0B-023E
QVR142F-274I
QRH124K-221M

Capacitors**Symbol**

C1301
C1402
C1407
C1411
C1412
C1508
△C1512
△C1513
△C1514
C1515
C1520
C1523
C1524
△C1531
△C1532
C1904
C1905

Description

BPE Cap. 3.3uF 50V A
Tan. Cap. 2.2uF 16V K
E Cap. 4.7uF 6.3V A
E Cap. 100uF 160V A
E Cap. 3.3uF 160V A
PP Cap. 5600uF 50V J
△PP Cap. 2000pF DC1500V J
△PP Cap. 2000pF DC1500V J
△PP Cap. 2000pF DC1500V J
PP Cap. 0.53uF DC1200V J
BPE Cap. 3.3uF 50V A
E Cap. 1uF 160V A
M Cap. 0.1uF 200V K
△PP Cap. 2000pF DC1500V J
△PP Cap. 1500pF DC1500V J
E Cap.
E Cap. 10uF 250V A

Part Number

QEN61HA-335Z
QEE51CK-225B
QEW51JA-475
QEW52CA-107
QEW52CA-335
QFP31HJ-562
QFZ0082-202
QFZ0082-202
QFZ0082-202
QFZ0067-534
QEN61HA-335Z
QEW62CA-105Z
QFM720K-104M
QFZ0082-202
QFZ0082-152
QEY0034-001
QEW52EA-106

Coils		
Symbol	Description	Part Number
L1502	Linearity Coil	A39835
L1503	Width Coil	C30380-A
L1504	Heater Choke	C30445-A
Transformers		
Symbol	Description	Part Number
T1501	Hor. Drive Transf.	A46022-BM
T1503	Side Pin Transf.	C39050-A
Semiconductors		
Symbol	Description	Part Number
IC1501	IC	HA11244
X1101	Si. Transistor	2SC1685(R)
X1102	Si. Transistor	2SA673(C)
X1103	Si. Transistor	2SC1685(R)
X1104	Si. Transistor	2SA673(C)
X1105	Si. Transistor	2SC1685(R)
X1106	Si. Transistor	2SA673(C)
X1301	Si. Transistor	2SC1685(R)
X1302	Si. Transistor	2SC1685(R)
X1303	Si. Transistor	2SA673(C)
X1304	Si. Transistor	2SC1685(R)
X1305	Si. Transistor	2SC1685(R)
X1401	Si. Transistor	2SD478
X1402	Si. Transistor	2SD478
X1501	Si. Transistor	2SC2610BK
X1901	Si. Transistor	2SC2688 (K.L.M.)
X1902	Si. Transistor	2SC1890A (E.F.)
D1101	• Si. Diode	W06A
D1102	Si. Diode	W06A
D1103	Si. Diode	W06A
D1301	Si. Diode	1SZ473H
D1401	Si. Diode	1SZ473H
D1402	Zener Diode	RD10F(C)
D1503	Si. Diode	HF-1
D1504	Si. Diode	V09E
D1505	Zener Diode	RD11E(B)
D1506	Si. Diode	W06A
D1507	Si. Diode	1SS81
D1508	Si. Diode	1SZ473H
△D1701	△Zener Diode	RD20EV2
△D1901	△Si. Diode	1S1887A
△D1902	△Si. Diode	1S1887A
△D1903	△Si. Diode	1S1887A
△D1904	△Si. Diode	1S1887A
△D1905	△Zener Diode	RD6.8EV3
Miscellaneous		
Symbol	Description	Part Number
△F1901	△Fuse 1.25A	QMF53U1-1R25S
△F1902	△UL Fuse 3A	QMF66U1-3R0S

REPLACEMENT PARTS LIST - ELECTROHOME 13'' MONITOR

Components identified by the Δ symbol in the PARTS LIST and on the Schematic have special characteristics important to safety.
DO NOT degrade the safety of the set through improper servicing.

Abbreviations for Resistors and Capacitors

Resistor		Capacitor	
C R	: Carbon Resistor	C Cap.	: Ceramic Capacitor
Comp. R	: Composition Resistor	M Cap	: Mylar Capacitor
OM R	: Oxide Metal Film Resistor	E Cap.	: Electrolytic Capacitor
V R	: Variable Resistor	BP E Cap.	: Bi-Polar (or Non-Polar) Electrolytic Capacitor
MF R	: Metal Film Resistor	MM Cap.	: Metalized Mylar Capacitor
CMF R	: Coating Metal Film Resistor	PP Cap.	: Polypropylene Capacitor
UNF R	: Nonflammable Resistor	MPP Cap.	: Metalized PP Capacitor
F R	: Fusible Resistor	PS Cap	: Polystyrol Capacitor
		Tan. Cap.	: Tantal Capacitor

NOTE: When ordering replacement parts please specify the part number as shown in this list including part name, and model number. Complete information will help expedite the order.
Use of substitute replacement parts which do not have the same safety characteristics as specified, may create shock, fire or other hazards. For maximum reliability and performance, all parts should be replaced by those having identical specifications.

Symbol	Description	Part Number
	Main P.C.B. Ass'y	SU-1103A
	CRT Socket P.C.B. Ass'y	SU-3016A

Outside of the P.C.B. Ass'y

Symbol	Description	Part Number
Δ V01	Δ Picture Tube	370ESB22(E)
Δ DY01	Δ Deflection Yoke	C29123-V
	PC Magnet	A76366-A
	Wedge	C30006
Δ R11	Δ Flyback Transf.	A19183-A
Δ R05	Δ Focus V R	A46606-A
Δ C04	UNF Resistor 220 Ω , 25W. K	QRF258K-221
X01	Δ C Capacitor 150 pF, AC1.5KV	QCZ0101-005
IC01	Si. Transistor	2SD869
L01	IC Regulator	STR383
	Degaussing Coil	21-1007-31
	Degaussing Coil Pin Terminal (2)	34-708-01
	Degaussing Coil Pin Terminal Housing	34-709-01
	Groundstrap Ass'y.	34-697-04
	Groundstrap Wire Terminal	34-228-03
	Groundstrap Spring (2)	35-3560-01
BR	Support Bracket RH	35-3919-01
BR	Support Bracket LH	35-3919-02
SC	SCREW 10- $\frac{1}{2}$ Pix Tube Mtg. (4)	31-631018-08
WA	Pyramidal Lockwasher (4)	33-255-01
	Clip P.C.B. Support (2)	33-629-02
	Ground Lug	34-33-04
CH	Chassis Base	38-452-01

Main P.C.B. Ass'y (SU-1103A) Parts List

Resistors

Symbol	Description	Part Number
R1406	V R 200 Ω	QVZ3230-022
R1408	V R 200 Ω	QVZ3230-022
R1410	CMF R 6.8 Ω 1W J	QRX019J-6R8
R1414	OM R 3.3K Ω 1W J	QRG019J-332
R1415	OM R 2.7K Ω 1W J	QRG019J-272
R1421	OM R 12K Ω 2W J	QRG029J-123
R1422	V R 10K Ω	QVZ3224-014H
Δ FR1401	Δ F R 68 Ω 2W K	QRH024K-680M
Δ R1503	Δ CMF R 11.8K Ω $\frac{1}{4}$ W +1%	QVR142F-1182
R1504	V R 5K Ω	QVZ3230-053
R1509	OM R 10K Ω 2W J	QRG029J-103
R1511	OM R 5.6K Ω 2W J	QRG029J-562
R1514	OM R 680 Ω 2W J	QRG029J-681
R1515	CMF R 8.2 Ω 1W J	QRX019J-8R2
R1522	CMF R 4.7 Ω 1W J	QRX019J-4R7
R1523	OM R 56 Ω 2W J	ORG029J-560
R1528	OM R 390 Ω 1W J	ORG019J-391
R1534	ZN R	ERZ-C05ZK471
VR1501	ZN R	ERZ-C05DK271
Δ R1703	Δ CMF R 39K Ω $\frac{1}{2}$ W +1%	QRV122F-3902
Δ R1704	Δ CMF R 7.68K Ω $\frac{1}{4}$ W +1%	QVR142F-7681
Δ R1901	Δ Posistor	A75414
R1902	UNF R 2 Ω 7W K	QRF076K-2R0
R1903	CMF R 5.6 Ω 3W J	QRX039J-5R6
R1904	OM R 10K Ω 2W J	QRG026J-103Z
Δ FR1901	Δ F R 220 Ω $\frac{1}{2}$ W K	QRH124K-221M

Capacitors

Symbol	Description	Part Number
C1402	Tan. Cap. 2.2uF 16V K	QEE51CK-225B
C1411	E Cap. 100uF 160V A	QEW52CA-107
C1412	E Cap. 3.3uF 160V A	QEW52CA-335
C1508	PP Cap. 5600pF 50V J	QFP31HJ-562
C1511	E Cap. 47uF 160V A	QEW52CA-476S
Δ C1512	Δ PP Cap. 2000pF DC1500V J	QFZ0082-202
Δ C1513	Δ PP Cap. 2000pF DC1500V J	QFZ0082-202
Δ C1514	Δ PP Cap. 2500pF DC1500V J	QFZ0082-252
C1515	PP Cap. 0.53uF DC1200V K	QFZ0067-534
C1520	BPE Cap. 1uF 50V A	QEN61HA-105Z
C1524	M Cap. 0.1uF 200V K	QFM72DK-682M
C1904	E Cap.	QEY0034-001
C1905	E Cap. 10uF 250V A	QEW52EA-106
Δ C1907	Δ MM Cap. 0.1uF AC150V Z	QFZ9008-104

Coils

Symbol	Description	Part Number
L1501	Peaking Coil	A75360-6
L1502	Liniarty Coil	A39934
L1503	Width Coil	C30380-A
L1504	Heater Choke	C30333-A
L1901	Line Filter	A39475-J

Transformers

Symbol	Description	Part Number
T1501	Hor. Drive Transf.	A46022-BM
T1503	Side Pin Transf.	C39050-A

Semiconductors**Symbol****Description****Part Number**

IC1501

I.C.

HA11244

X1101

Si. Transistor

2SC1685(R)

X1102

Si. Transistor

2SA673(C)

X1103

Si. Transistor

2SC1685(R)

X1104

Si. Transistor

2SA673(C)

X1105

Si. Transistor

2SC1685(R)

X1106

Si. Transistor

2SA673(C)

X1301

Si. Transistor

2SC1685(R)

X1302

Si. Transistor

2SC1685(R)

X1303

Si. Transistor

2SA673(C)

X1304

Si. Transistor

2SC1685(R)

X1305

Si. Transistor

2SC1685(R)

X1401

Si. Transistor

2SD478

X1402

Si. Transistor

2SD478

X1501

Si. Transistor

2SC2610BK

X1701

Si. Transistor

2SC1685(P-S)

D1101

Si. Diode

W06A

D1102

Si. Diode

W06A

D1103

Si. Diode

W06A

D1301

Si. Diode

1S2473H

D1401

Si. Diode

1S2473H

D1402

Zener Diode

RD10F(C)

D1503

Si. Diode

HF-1

D1504

Si. Diode

V09E

D1505

Zener Diode

RD11E(B)

D1506

Si. Diode

W06A

D1507

Si. Diode

1SS81

D1508

Si. Diode

1S2473H

△D1701

△Zener Diode

RD20EV2

△D1901

△Si. Diode

1S1887A

△D1902

△Si. Diode

1S1887A

△D1903

△Si. Diode

1S1887A

△D1904

△Si. Diode

1S1887A

Miscellaneous**Symbol****Description****Part Number**

△F1901

△Fuse 1A

QMF53U1-1R0S

△F1902

△UL Fuse 3A

QMF66U1-3R0S

CRT Socket P.C.B. Ass'y (SU-3016A) Parts List

Resistors

Symbol	Description	Part Number
R3105	V R 200 Ω	QVZ3234-022
R3106	V R 200 Ω	QVZ3234-022
R3113	V R 5K Ω	QVZ3234-053
R3114	V R 5K Ω	QVZ3234-053
R3115	V R 5K Ω	QVZ3234-053
R3116	OM R 10K Ω 2W J	QRG029J-103
R3117	OM R 10K Ω 2W J	QRG029J-103
R3118	OM R 10K Ω 2W J	QRG029J-103
R3119	Comp. R 3.3K Ω 1/2W K	QRZ0039-332
R3120	Comp. R 3.3K Ω 1/2W K	QRZ0039-332
R3121	Comp. R 3.3K Ω 1/2W K	QRZ0039-332

Capacitors

Symbol	Description	Part Number
C3107	E Cap. 10uF 250V A	QEW52EA-106
C3108	C Cap. 1000pF DC1400V P	QCZ9001-102M

Coils

Symbol	Description	Part Number
L3101	Peaking coil	QQL043K-101

Semiconductors

Symbol	Description	Part Number
X3101	Si. Transistor	2SC2611
X3102	Si. Transistor	2SC2611
X3103	Si. Transistor	2SC2611

Miscellaneous

Symbol	Description	Part Number
\triangle	\triangle CRT Socket	A75522

VII. Coin Door Maintenance

SPECIAL NOTE: If you have any questions about the coin acceptors in your game(s), please feel free to contact their manufacturers. Each manufacturer's name is **PROMINENTLY** imprinted on every acceptor mechanism.

Metal mechanisms only:
COIN MECHANISMS, INC.
817 Industrial Drive
Elmhurst, IL 60126
Phone (312) 279-9150

Metal and Plastic mechanisms:
COINCO COIN ACCEPTORS, INC.
860 Eagle Drive
Bensenville, IL 60106
Phone (312) 766-6781

COIN DOOR MAINTENANCE

METAL COIN ACCEPTOR MECHANISMS

Periodically, the metal coin acceptor mechanism(s) must be removed from the coin door and cleaned.

1. **Make sure the power to the game is off.**
2. Unlock and open the coin door.

3. Remove the coin acceptor mechanism as shown in Figure 7-1.
 - ☐ Push down on the two spring loaded latches.
 - ☐ While holding the latches down, pull the top of the coin acceptor mechanism toward you.
 - ☐ Release the latches and lift out the coin acceptor mechanism.

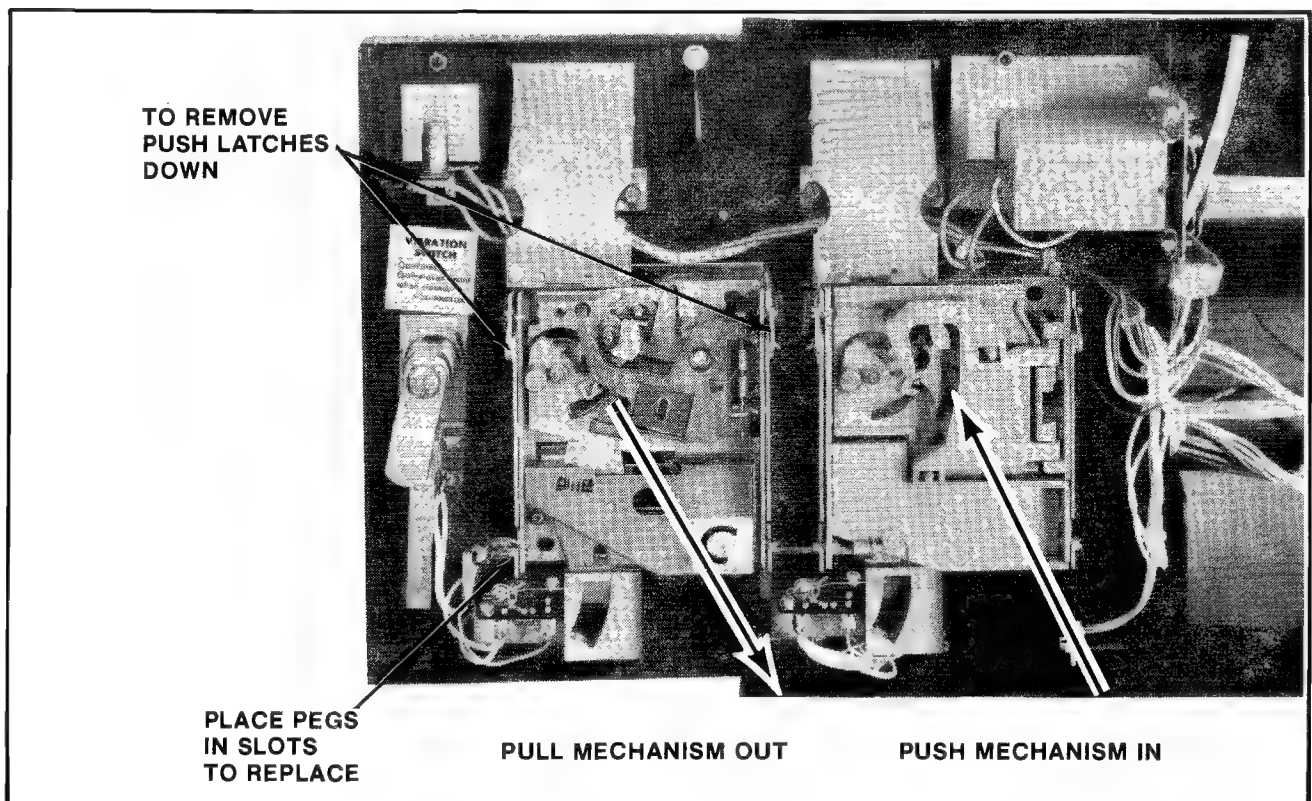


Figure 7-1 Removing and replacing coin acceptor

4. Clean the magnet of all foreign particles. See Figure 7-2.
 - ☐ This may be accomplished by swinging the gate open as shown in the above figure.
5. Remove the cradles and undersize levers and clean the bushings. (A pipe cleaner makes a good bushing cleaner.)
 - ☐ Also clean the pivot pin.
6. Whenever needed, the coin acceptor should be cleaned with hot water and cleanser in the following manner:
 - ☐ Place the coin acceptor in boiling water for about ten minutes.

CAUTION: BE CAREFUL NOT TO BURN YOURSELF.

- ☐ Next, use a brush and kitchen cleaner to remove all remaining foreign matter from the unit.
- ☐ Rinse the coin acceptor in clean boiling water.
- ☐ Dry the coin acceptor thoroughly by using filtered compressed air to blow it dry.

NOTE: The reason we recommend using boiling water is that it evaporates faster than cold water and speeds drying time.

7. To lubricate the coin acceptor:

- ☐ Use **ONLY** powdered graphite and put it **ONLY** on the moving parts of the coin acceptor. These parts are called out in Figure 7-3.
- ☐ Be extremely careful to keep the powdered graphite away from paths that are traveled by the coins.

**— WARNING —
DO NOT USE OIL
TO LUBRICATE THE
COIN ACCEPTOR.**

8. Check the coin chute for obstructions such as: paper, gum, etc.
9. Reinstall the coin acceptor to the coin door. See Figure 7-1.
 - ☐ Place the two pegs at the coin acceptor's base into their retaining slots.
 - ☐ Now push the top of the coin acceptor toward the coin door until it snaps in place and is held there by the two spring loaded latches.
10. Close and lock the coin door.

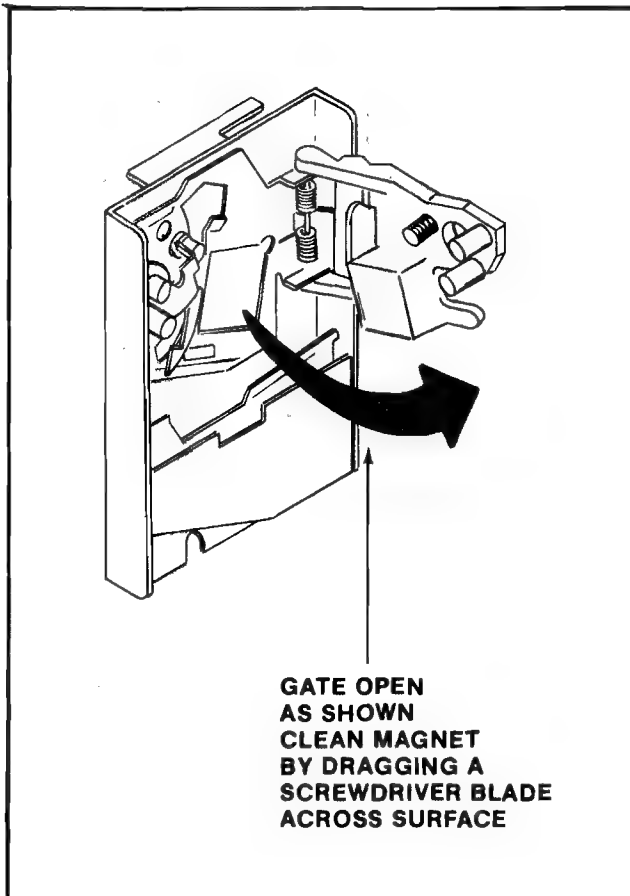


Figure 7-2 Cleaning the metal coin acceptor

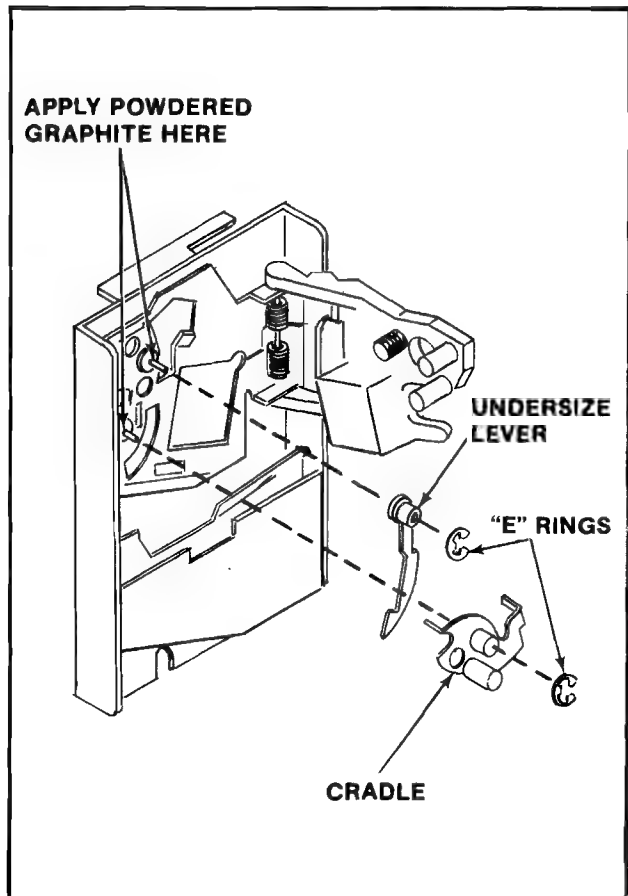


Figure 7-3 Lubricating the metal coin acceptor

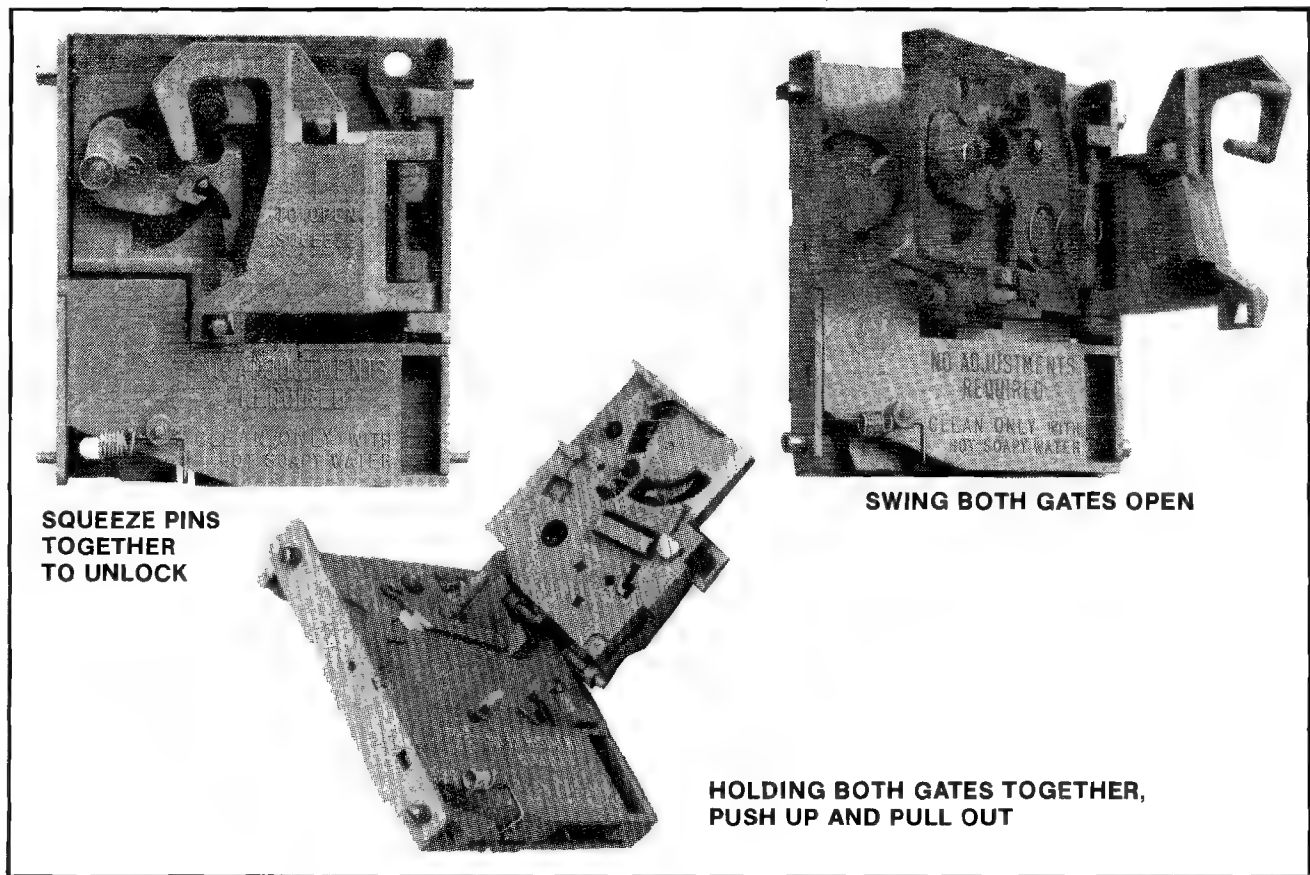


Figure 7-4 Opening the plastic coin acceptor

PLASTIC COIN ACCEPTOR MECHANISMS

The plastic coin acceptor mechanism(s) must be removed periodically from the coin door and cleaned.

1. **Make sure the power to the game is off.**
2. Unlock and open the coin door.
3. Remove the coin acceptor mechanism(s) as shown in Figure 7-1.
 - ☐ Push down on the two spring loaded latches.
 - ☐ While holding the latches down, pull the top of the acceptor mechanism toward you.
 - ☐ Release the latches and lift out the mechanism.
4. Squeeze the two pins indicated in Figure 7-4 together to open the mechanism and break it down into its three basic parts.
 - ☐ Clean the mechanism in hot soapy water. It never rusts.
 - ☐ Rinse the mechanism in clean hot water and allow it to dry.

☐ Reassemble the mechanism (it never needs lubrication).

5. Check the coin chute for obstructions such as: paper, gum, etc.
6. Reinstall the coin acceptor to the coin door. See Figure 7-5.
 - ☐ Place the two pegs at the coin acceptor's base into their retaining slots.
 - ☐ Now push the top of the coin acceptor toward the coin door until it snaps in place and is held there by the two spring loaded latches.
7. Close and lock the coin door.

NOTE: See Figure 7-6 for instructions on how to set the plastic coin acceptor mechanisms to either accept or reject Canadian quarters.

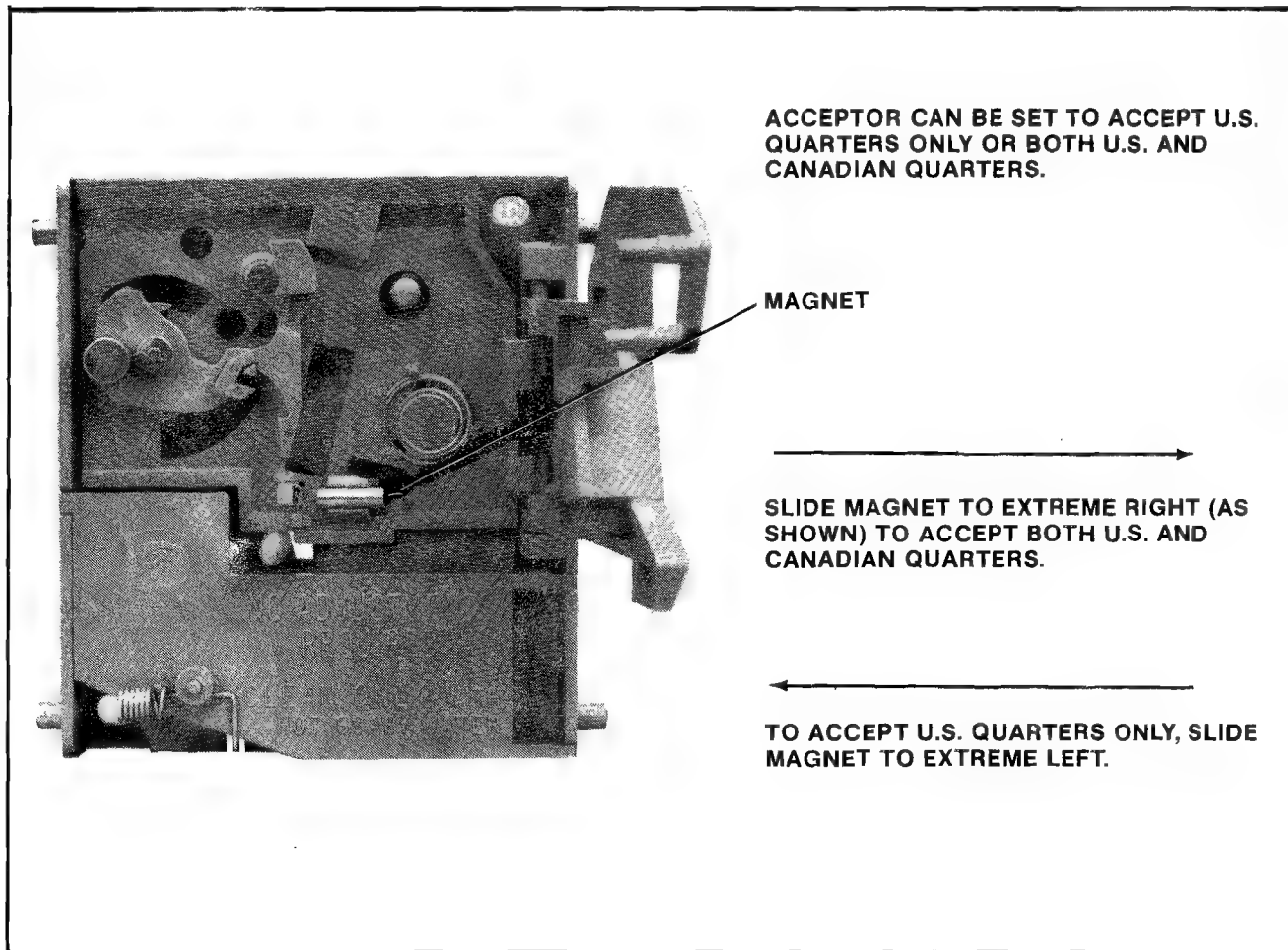
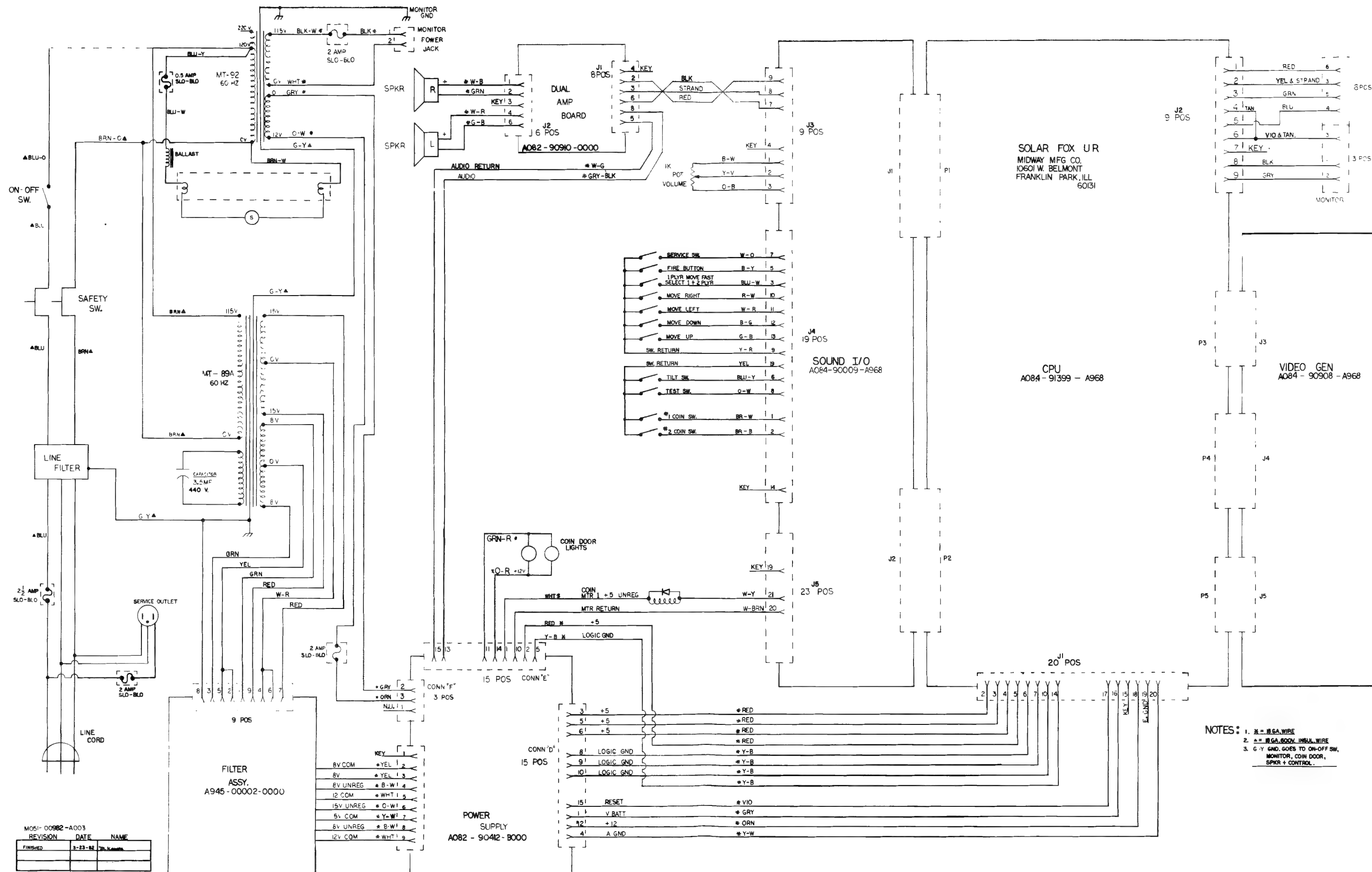
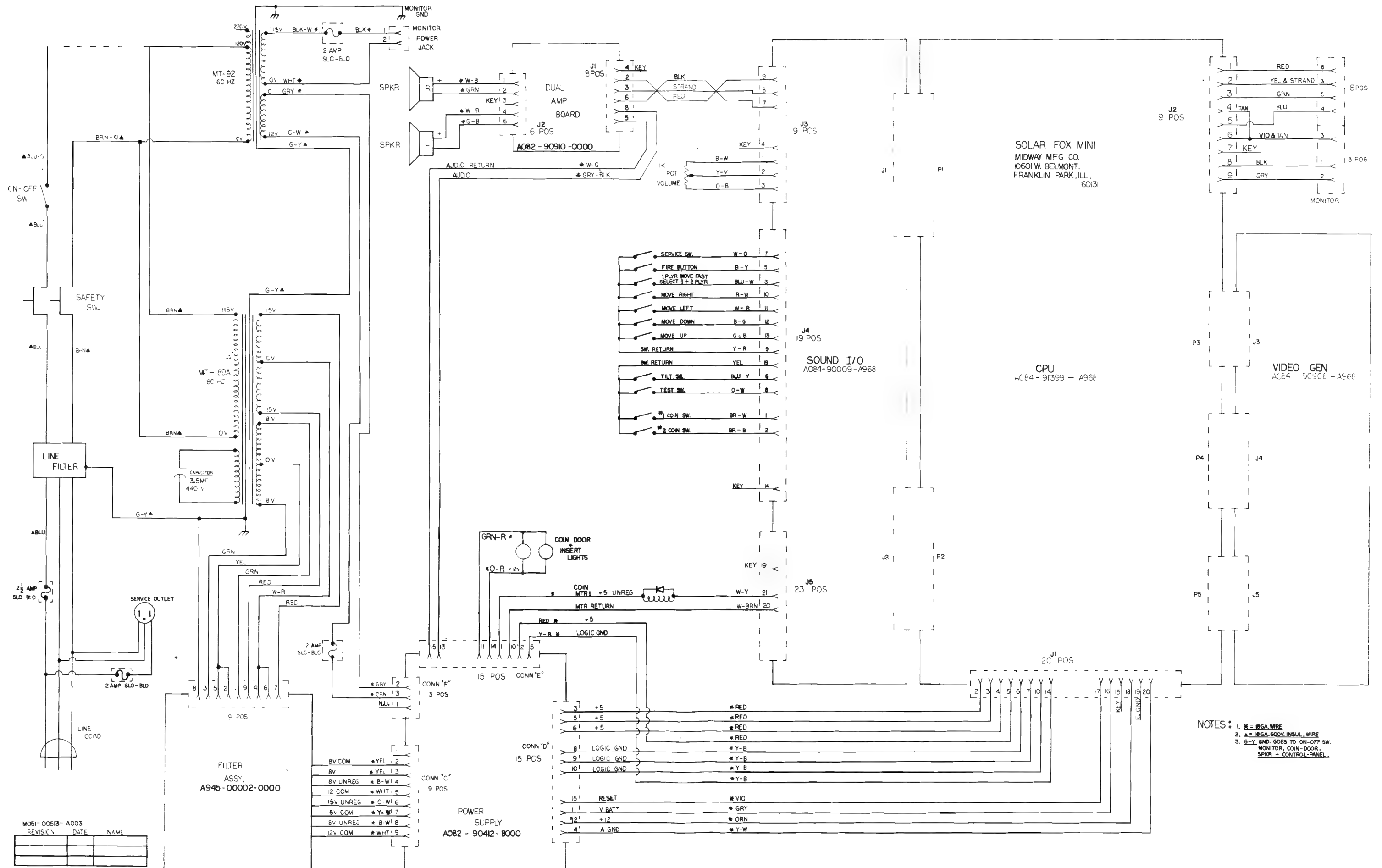
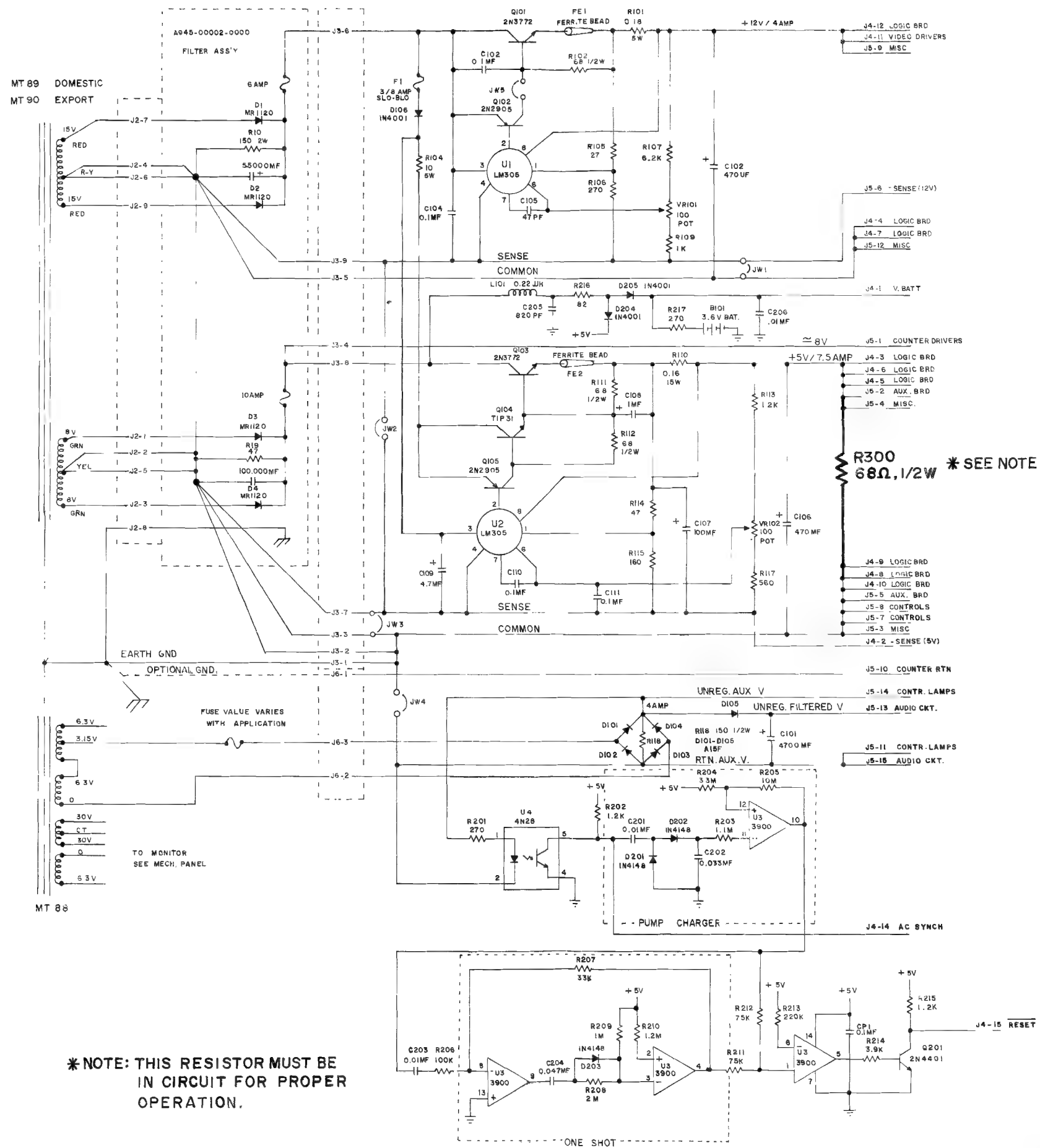


Figure 7-5 Changing the plastic coin acceptor to accept American or Canadian quarters.









* NOTE: THIS RESISTOR MUST BE
IN CIRCUIT FOR PROPER
OPERATION.

PROJECT ENG. L. DEKKER

DO NOT SCALE DRAWING

DATE: 6/11/82

FULL SCALE: 1 PER

SCHEMATIC DRAWING

125VA POWER SUPPLY

A082-90412-C000

SOLARFOX

MIDWAY MFG. CO.

PANEL NO. 11

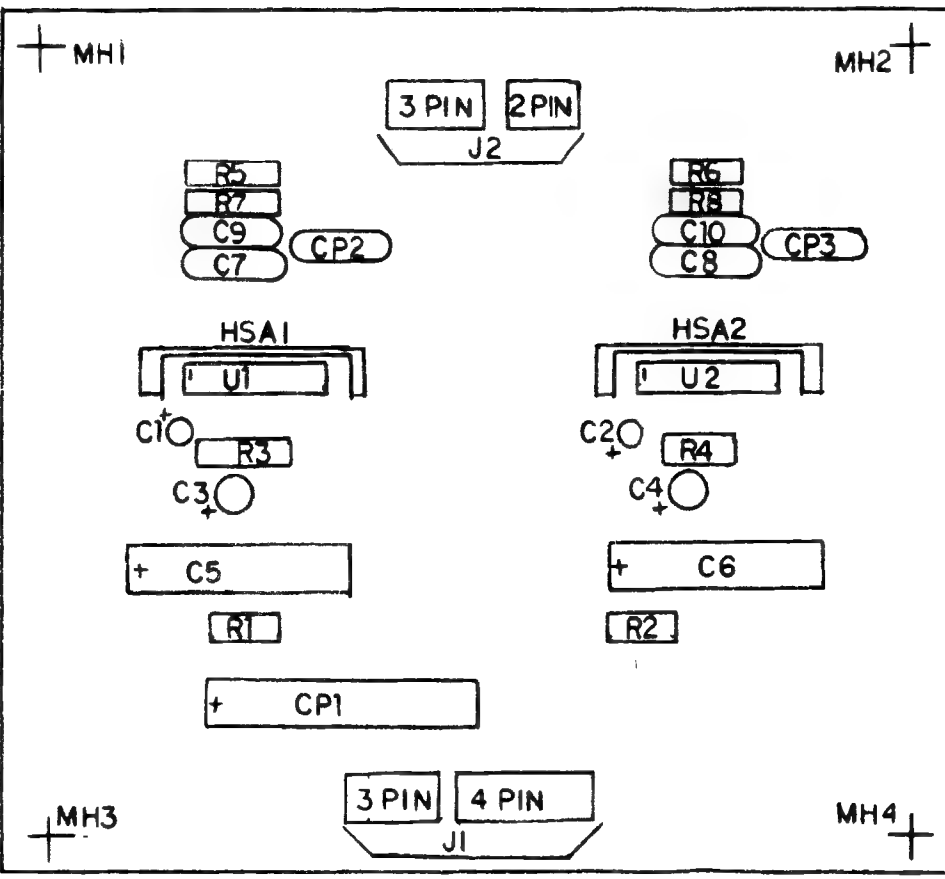
M051-0945-C007

DATE: 6/11/82

BY: L. DEKKER

DESIGNATION LIST

DESIGNATION	DESCRIPTION
C1,C2	4.7mf 25v rd.tant.
C3,C4	22mf 6v " "
C5,C6	470mf 6v ax.elect.
C7-C10	.1mf 50v ax.cr.
CP1	220mf 25v ax.elect.
CP2,CP3	.1mf 50v ax.cr.
R1,R2	2.7K Ω 1/4w 5% CRBN.
R3,R4	27 Ω " " "
R5-R8	1 Ω 1/2w " "
U1,U2	MB3730
J1	3 PIN STRT. KK156
J2	4 " " " "
HSA1,2	HEATSINK ASSY.
MH1-MH4	HEYCO BUSHING



CROSS REFERENCE LIST

DESCRIPTION	QTY	DESIGNATION	PART NO.
.1mf 50v ax.cr.	6	C7-C10, CP2,CP3	0986-00800-1100
4.7mf 25v rd.tant.	2	C1,C2	0986-00800-3100
22mf 6v " "	2	C3,C4	0986-00800-1600
220mf 25v ax.elec.	1	CP1	0986-00800-3200
470mf 6v " "	2	C5,C6	0986-00800-1700
1 Ω 1/2w 5%	4	R5-R8	0062-026D3-1XXX
27 Ω 1/4w " "	2	R3,R4	0062-068B3-1XXX
2.7K " "	2	R1,R2	0062-199B3-1XXX
MB3730	2	U1,U2	0066-188XX-XX4X
2 PIN STRT. KK156	1	J2	3000-16367-0200
3 " " " "	2	J1,J2	3000-16367-0300
4 " " " "	1	J1	3000-16367-0400
HEATSINK ASSY.	2	HSA1, HSA2	0986-00804-1800
HEYCO BUSHING	4	MH1-MH4	0017-00042-0014
PC BOARD	1		A080-90910-D000

NOTE: THIS DRAWING GOOD FOR BOTH
D AND E VERSION BOARDS.

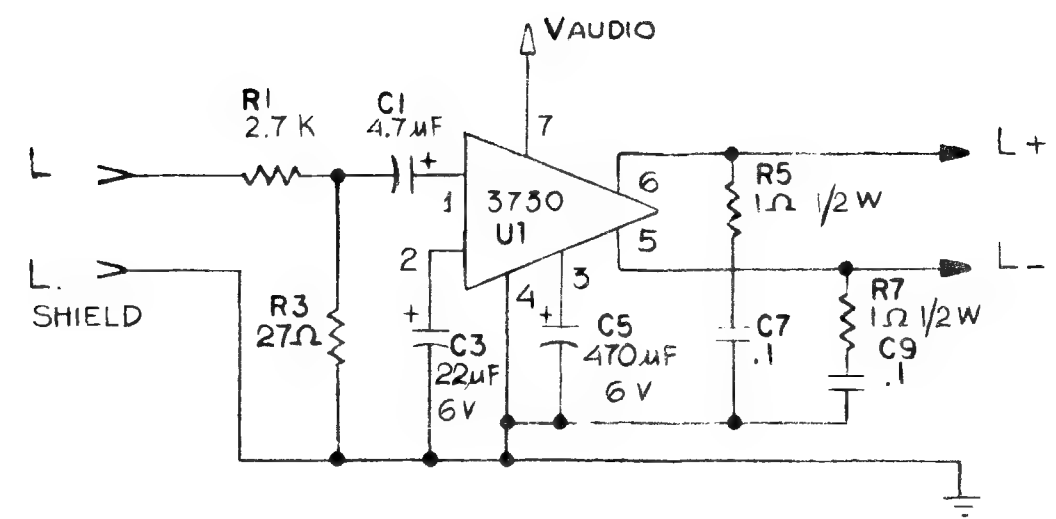
PROJECT ENG. C.MEDNICK

THIS DWG. IS CONFIDENTIAL & PROPERTY OF MIDWAY MFG. CO.

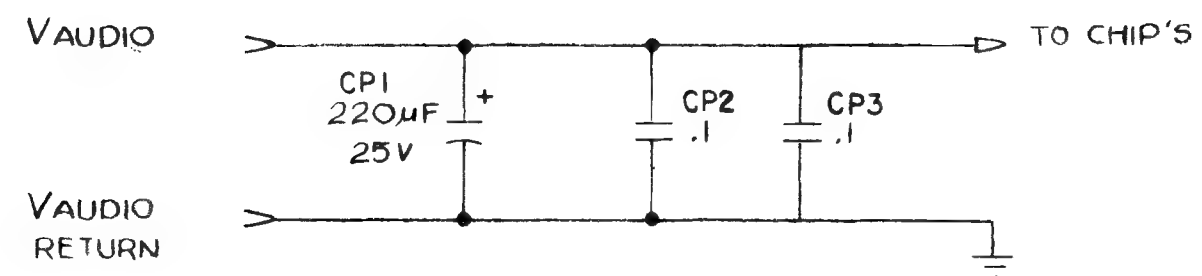
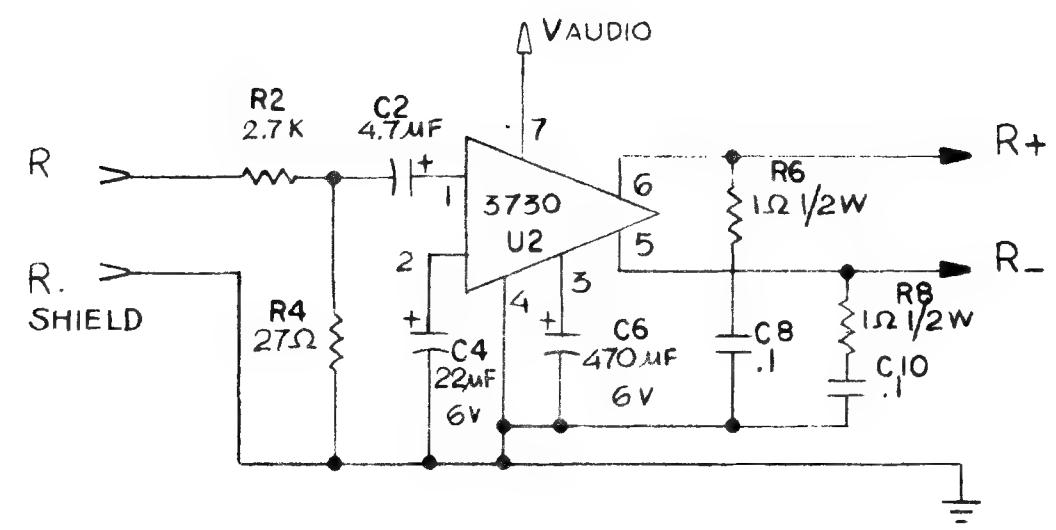
M051-00986-D010

DIM. TOLERANCES UNLESS OTHERWISE SPEC. CONCENTRICITY T.I.R. .002 FRACTIONAL $\pm 1/64$ DECIMAL $\pm .005$ HOLE DIA. $+.002-.000$ ANGLE $\pm 1/2^\circ$ DO NOT SCALE DWG	FIRST USED ON DRN TJK MECH CHK ELEC CHK C. M. M.	DATE 12-14-81 SCALE FULL MATERIAL FINISH	MIDWAY MFG. CO. FRANKLIN PK., IL. 60131 A BALLY CO.	DUAL PWR. AMP. ASSY A082-90910-D000	REVISIONS PART NO. M051-00986-D010
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J1		
PIN 1	—	N.C.
" 2	—	L. AUDIO
" 3	—	L. SHIELD
" 4	—	KEY
" 5	—	V AUDIO RETURN
" 6	—	R. AUDIO
" 7	—	R. SHIELD
" 8	—	V AUDIO



J2		
PIN 1	—	R +
" 2	—	R -
" 3	—	KEY
" 4	—	L +
" 5	—	N.C.
" 6	—	L -



NOTE: THIS DRAWING GOOD FOR BOTH
D AND E VERSION BOARDS.

PROJECT ENG. C MEDNICK

THIS DWG. IS CONFIDENTIAL & PROPERTY OF MIDWAY MFG. CO.

DIM. TOLERANCES UNLESS OTHERWISE SPEC. CONCENTRICITY T.I.R.002 FRACTIONAL ± .1/64 DECIMAL ± .005 HOLE DIA. +.002— .000 ANGLE ± 1/2° DO NOT SCALE DWG		FIRST USED ON MCR II DRN T.V.T DATE 12-14-81 SCALE FULL MECH CHK _____ MAT'L _____ ELEC CHK C.M.M. FINISH _____	MIDWAY MFG. CO. FRANKLIN PK., IL. 60131 A BALLY CO.	REVISIONS PART NO. M O 5 I - 00986 - D011
		DUAL PWR AMP A082-90910-D000		

DESIGNATION LIST

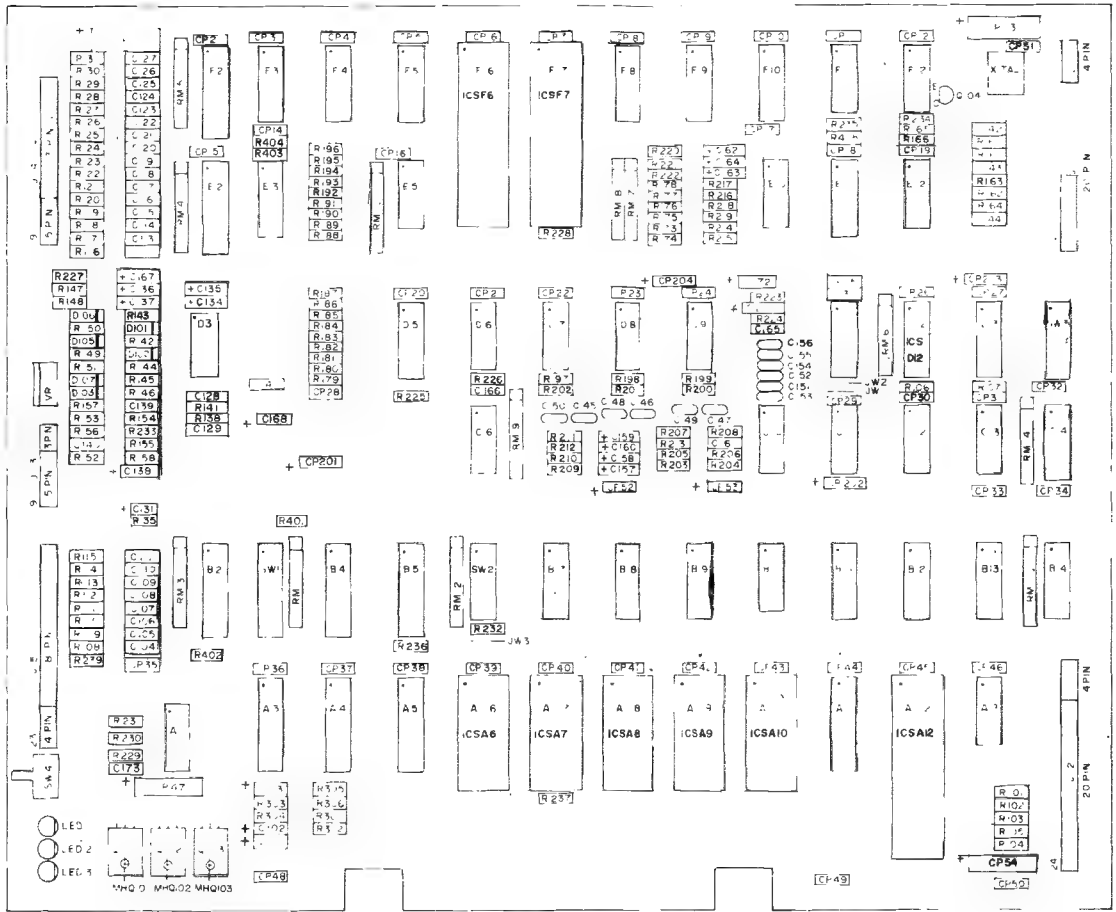
DESIGNATION	DESCRIPTION	DESIGNATION	DESCRIPTION
C101-C103	10 MF 25V AX TANT	D101 D103, D105-107	1N4148
C112 C117	1 MF 50V AX CER	Q101 Q103	TIP 110
C126 C129	47 PF 50V AX CER	Q104	2N4403
C131	10 MF 25V AX TANT	KC 1A	7406
C134, C137	1 MF 20V AX TANT	" 4A	74LS273
C138	10 MF 25V AX TANT	" 5A	74LS374
C139	247 MF 100V MYLAR	" 6A	1KX8 RAM
C140 C141	1 MF 50V AX CER	" 7A	ROM/EPROM O
C142	100 PF 50V AX CER	" 8A	" " 1
C143	1 MF 50V AX CER	" 9A	" " 2
C144	13 PF 50V AX CER	" 10A	" " 3
C145 C156	10002 MF 100V 10% MYLAR	" 11A	74LS245
C157 C159	1 MF 50V AX TANT	" 12A	Z 80 CPU
C161	10 PF 50V AX CER	" 13A	74LS08
C162 C164	1 MF 20V AX TANT	" 14B	74LS244
C165	10 MF 25V AX TANT	" 15B	74LS138
C166 C168, C172	10 MF 25V AX TANT	" 16B	74LS470
C173	470 MF 16V AX ELECT	" 17B	74LS32
CP1	401 MF 50V AX CER	" 18B	74LS60
CP2 CP12	470 MF 16V AX ELECT	" 19B	74LS108
CP13	101 MF 50V AX CER	" 20B	74LS14
CP14 CP33	10 MF 25V AX TANT	" 21B	74LS14
CP34	401 MF 50V AX CER	" 22B	74LS14
CP35 CP46	470 MF 16V AX ELECT	" 23B	74LS14
CP47	101 MF 50V AX CER	" 24B	74LS14
CP48 CP51	470 MF 16V AX ELECT	" 25B	74LS14
CP52 CP53	10 MF 25V AX TANT	" 26B	74LS14
CP54	470 MF 16V AX ELECT	" 27B	74LS14
CP20 CP204	10 MF 25V AX TANT	" 28B	74LS14
R101 R107	4.7 K 1/4W 5% CARBON	" 29B	74LS14
R116 R117	220 OHM	" 30B	74LS14
R125	3.3 K	" 31B	74LS14
R138 R141	180 K	" 32B	74LS14
R 42	100 K	" 33B	74LS14
R144 R145	620K	" 34B	74LS14
R146	10 K	" 35B	74LS14
R148	10 K	" 36B	74LS14
R149 R150	620K	" 37B	74LS14
R151	10 K	" 38B	74LS14
R152	10 K	" 39B	74LS14
R153	10 K	" 40B	74LS14
R154	10 K	" 41B	74LS14
R155 R156	10 K	" 42B	74LS14
R157 R158	10 K	" 43B	74LS14
R159 R16	10 K	" 44B	74LS14
R162	10 K	" 45B	74LS14
R164	10 K	" 46B	74LS14
R165 R166	10 K	" 47B	74LS14
R173 R178	10 K	" 48B	74LS14
R179, R202	10 K	" 49B	74LS14
R197-R202	10 K	" 50B	74LS14
R203-R204	10 K	" 51B	74LS14
R205-R206	10 K	" 52B	74LS14
R207-R208	10 K	" 53B	74LS14
R209-R210	10 K	" 54B	74LS14
R211-R212	10 K	" 55B	74LS14
R213-R214	10 K	" 56B	74LS14
R215-R216	10 K	" 57B	74LS14
R217-R218	10 K	" 58B	74LS14
R219-R220	10 K	" 59B	74LS14
R221-R222	10 K	" 60B	74LS14
R223-R224	10 K	" 61B	74LS14
R225-R226	10 K	" 62B	74LS14
R227-R228	10 K	" 63B	74LS14
R229-R230	10 K	" 64B	74LS14
R231-R232	10 K	" 65B	74LS14
R233-R234	10 K	" 66B	74LS14
R235-R236	10 K	" 67B	74LS14
R237-R238	10 K	" 68B	74LS14
R239-R240	10 K	" 69B	74LS14
R241-R242	10 K	" 70B	74LS14
R243-R244	10 K	" 71B	74LS14
R245-R246	10 K	" 72B	74LS14
R247-R248	10 K	" 73B	74LS14
R249-R250	10 K	" 74B	74LS14
R251-R252	10 K	" 75B	74LS14
R253-R254	10 K	" 76B	74LS14
R255-R256	10 K	" 77B	74LS14
R257-R258	10 K	" 78B	74LS14
R259-R260	10 K	" 79B	74LS14
R261-R262	10 K	" 80B	74LS14
R263-R264	10 K	" 81B	74LS14
R265-R266	10 K	" 82B	74LS14
R267-R268	10 K	" 83B	74LS14
R269-R270	10 K	" 84B	74LS14
R271-R272	10 K	" 85B	74LS14
R273-R274	10 K	" 86B	74LS14
R275-R276	10 K	" 87B	74LS14
R277-R278	10 K	" 88B	74LS14
R279-R280	10 K	" 89B	74LS14
R281-R282	10 K	" 90B	74LS14
R283-R284	10 K	" 91B	74LS14
R285-R286	10 K	" 92B	74LS14
R287-R288	10 K	" 93B	74LS14
R289-R290	10 K	" 94B	74LS14
R291-R292	10 K	" 95B	74LS14
R293-R294	10 K	" 96B	74LS14
R295-R296	10 K	" 97B	74LS14
R297-R298	10 K	" 98B	74LS14
R299-R300	10 K	" 99B	74LS14
R301-R302	10 K	" 100B	74LS14
R303-R304	10 K	" 101B	74LS14
R305-R306	10 K	" 102B	74LS14
R307-R308	10 K	" 103B	74LS14
R309-R310	10 K	" 104B	74LS14
R311-R312	10 K	" 105B	74LS14
R313-R314	10 K	" 106B	74LS14
R315-R316	10 K	" 107B	74LS14
R317-R318	10 K	" 108B	74LS14
R319-R320	10 K	" 109B	74LS14
R321-R322	10 K	" 110B	74LS14
R323-R324	10 K	" 111B	74LS14
R325-R326	10 K	" 112B	74LS14
R327-R328	10 K	" 113B	74LS14
R329-R330	10 K	" 114B	74LS14
R331-R332	10 K	" 115B	74LS14
R333-R334	10 K	" 116B	74LS14
R335-R336	10 K	" 117B	74LS14
R337-R338	10 K	" 118B	74LS14
R339-R340	10 K	" 119B	74LS14
R341-R342	10 K	" 120B	74LS14
R343-R344	10 K	" 121B	74LS14
R345-R346	10 K	" 122B	74LS14
R347-R348	10 K	" 123B	74LS14
R349-R350	10 K	" 124B	74LS14
R351-R352	10 K	" 125B	74LS14
R353-R354	10 K	" 126B	74LS14
R355-R356	10 K	" 127B	74LS14
R357-R358	10 K	" 128B	74LS14
R359-R360	10 K	" 129B	74LS14
R361-R362	10 K	" 130B	74LS14
R363-R364	10 K	" 131B	74LS14
R365-R366	10 K	" 132B	74LS14
R367-R368	10 K	" 133B	74LS14
R369-R370	10 K	" 134B	74LS14
R371-R372	10 K	" 135B	74LS14
R373-R374	10 K	" 136B	74LS14
R375-R376	10 K	" 137B	74LS14
R377-R378	10 K	" 138B	74LS14
R379-R380	10 K	" 139B	74LS14
R381-R382	10 K	" 140B	74LS14
R383-R384	10 K	" 141B	74LS14
R385-R386	10 K	" 142B	74LS14
R387-R388	10 K	" 143B	74LS14
R389-R390	10 K	" 144B	74LS14
R391-R392	10 K	" 145B	74LS14
R393-R394	10 K	" 146B	74LS14
R395-R396	10 K	" 147B	74LS14
R397-R398	10 K	" 148B	74LS14
R399-R400	10 K	" 149B	74LS14
R401-R402	10 K	" 150B	74LS14
R403-R404	10 K	" 151B	74LS14
R405-R406	10 K	" 152B	74LS14
R407-R408	10 K	" 153B	74LS14
R409-R410	10 K	" 154B	74LS14
R411-R412	10 K	" 155B	74LS14
R413-R414	10 K	" 156B	74LS14
R415-R416	10 K	" 157B	74LS14
R417-R418	10 K	" 158B	74LS14
R419-R420	10 K	" 159B	74LS14
R421-R422	10 K	" 160B	74LS14
R423-R424	10 K	" 161B	74LS14
R425-R426	10 K	" 162B	74LS14
R427-R428	10 K	" 163B	74LS14
R429-R430	10 K	" 164B	74LS14
R431-R432	10 K	" 165B	74LS14
R433-R434	10 K	" 166B	74LS14
R435-R436	10 K	" 167B	74LS14
R437-R438	10 K	" 168B	74LS14
R439-R440	10 K	" 169B	74LS14
R441-R442	10 K	" 170B	74LS14
R443-R444	10 K	" 171B	74LS14
R445-R446	10 K	" 172B	74LS14
R447-R448	10 K	" 173B	74LS14
R449-R450	10 K	" 174B	74LS14
R451-R452	10 K	" 175B	74LS14
R453-R454	10 K	" 176B	74LS14
R455-R456	10 K	" 177B	74LS14
R457-R458	10 K	" 178B	74LS14
R459-R460	10 K	" 179B	74LS14
R461-R462	10 K	" 180B	74LS14
R463-R464	10 K	" 181B	74LS14
R465-R466	10 K	" 182B	74LS14
R467-R468	10 K	" 183B	74LS14
R469-R470	10 K	" 184B	74LS14
R471-R472	10 K	" 185B	74LS14
R473-R474	10 K	" 186B	74LS14
R475-R476	10 K	" 187B	74LS14
R477-R478	10 K	" 188B	74LS14
R479-R480	10 K	" 189B	74LS14
R481-R482	10 K	" 190B	74LS14
R483-R484	10 K	" 191B	74LS14
R485-R486	10 K	" 192B	74LS14
R487-R488	10 K	" 193B	74LS14
R489-R490	10 K	" 194B	74LS14
R491-R492	10 K	" 195B	74LS14
R493-R494	10 K	" 196B	74LS14
R495-R496	10 K	" 197B	74LS14
R497-R498	10 K	" 198B	74LS14
R499-R500	10 K	" 199B	74LS14
R501-R502	10 K	" 200B	74LS14
R503-R504	10 K	" 201B	74LS14
R505-R506	10 K	" 202B	74LS14
R507-R508	10 K	" 203B	74LS14
R509-R510	10 K	" 204B	74LS14
R511-R512	10 K	" 205B	74LS14
R513-R514	10 K	" 206B	74LS14
R515-R516	10 K	" 207B	74LS14
R517-R518	10 K	" 208B	74LS14
R519-R520	10 K	" 209B	74LS14
R521-R522	10 K	" 210B	74LS14
R523-R524	10 K	" 211B	74LS14
R525-R526	10 K	" 212B	74LS14
R527-R528	10 K	" 213B	74LS14
R529-R530	10 K	" 214B	74LS14
R531-R532	10 K	" 215B	74LS14
R533-R534	10 K	" 216B	74LS14
R535-R536	10 K	" 217B	74LS14
R537-R538	10 K	" 218B	74LS14
R539-R540	10 K	" 219B	74LS14
R541-R542	10 K	" 220B	74LS14
R543-R544	10 K	" 221B	74LS14
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R559-R560	10 K	" 229B	74LS14
R561-R562	10 K	" 230B	74LS14
R563-R564	10 K	" 231B	74LS14
R565-R566	10 K	" 232B	74LS14
R567-R568	10 K	" 233B	74LS14
R569-R570	10 K	" 234B	74LS14
R571-R572	10 K	" 235B	74LS14
R573-R574	10 K	" 236B	74LS14
R575-R576	10 K	" 237B	74LS14
R577-R578	10 K	" 238B	74LS14
R579-R580	10 K	" 239B	74LS14
R581-R582	10 K	" 240B	74LS14
R583-R584	10 K	" 241B	74LS14
R585-R586	10 K	" 242B	74LS14
R587-R588	10 K	" 243B	74LS14
R589-R590	10 K	" 244B	74LS14
R591-R592	10 K	" 245B	74LS14
R593-R594	10 K	" 246B	74LS14
R595-R596	10 K	" 247B	74LS14
R597-R598	10 K	" 248B	74LS14
R599-R600	10 K	" 249B	74LS14
R601-R602	10 K	" 250B	74LS14
R603-R604	10 K	" 251B	74LS14
R605-R606	10 K	" 252B	74LS14
R607-R608	10 K	" 253B	74LS14
R609-R610	10 K	" 254B	74LS14
R611-R612	10 K	" 255B	74LS14
R613-R614	10 K	" 256B	74LS14
R615-R616	10 K	" 257B	74LS14
R617-R618	10 K	" 258B	74LS14
R619-R620	10 K	" 259B	74LS14
R621-R622	10 K	" 260B	74LS14
R623-R624	10 K	" 261B	74LS14
R625-R626	10 K	" 262B	74LS14
R627-R628	10 K	" 263B	74LS14
R629-R630	10 K	" 264B	74LS14
R631-R632	10 K	" 265B	74LS14
R633-R634	10 K</		

CROSS REFERENCE LIST

DESCRIPTION	QUANTITY	DESIGNATION	PART NO.
33 PF 50V 5% AX CER	1	C144	0886-00800-6800
47 PF 50V AX CER	2	C128, C129	0886-00800-2800
220 PF 50V AX CER	1	C130	0886-00800-2900
100 PF 50V 5% AX CER	1	C142	0886-00800-1000
330 PF 50V AX CER	2	C161, C185	0886-00800-1300
0022 MF 100V 10% MYLAR	12	C145-C156	0886-00800-1200
047 MF 100V MYLAR	1	C139	0886-00800-2800
01 MF 50V AX CER	49	CP2-CP12 CP14-CP33 CP35-CP48, CP48-CP51, C140, C141, C173	0886-00800-2000
1 MF 50V AX CER	17	C112-127, C143	0886-00800-1100
1 MF 20V AX TANT	8	C157-158, C162-C164, C134, C137	0886-00800-1400
10 MF 25V AX TANT	16	CP34, CP52-CP53, CP201-CP204 C101, C103, C131, C138 C172, C66 C68, C72	0886-00800-0700
470 MF 16V AX ELECT	4	CP1, CP13 CP47, CP54	0886-00800-2700
22 OHM 1/4W	1	R164	0062-06383-1XXX
100 OHM II	1	R239	0062-110B3-1XXX
220 OHM 1/4W	17	R116-131, R162	0062-135B3-1XXX
300 OHM II	1	R231	0062-141B3-1XXX
330 OHM II	2	R160 R161	0062-144B3-1XXX
1 K II	3	R153, R227, R401	0062-170B3-1XXX
1.2 K II	3	R157, R158, R163	0062-183B3-1XXX
2.7 K II	6	R301 R306	0062-199B3-1XXX
3 K II	1	R233	0062-201B3-1XXX
4.7 K II	17	R101-R107, R165-166, R225 226, R228 R232, R234 R235, R402, R405	0062-211B3-1XXX
5.6 K II	12	R173 R178, R107 R202	0062-215B3-1XXX
10 K II	4	R156, R158, R148, R151	0062-227B3-1XXX
13 K "	6	R209-R211, R220-R222	0062-233B3-1XXX
24 K "	2	R179, R196	0062-245B3-1XXX
27 K "	2	R213, R224	0062-247B3-1XXX
100 K "	15	R1203-REC08, R214-R219	0062-251B3-1XXX
120K "	2	R42, R48	0062-275B3-1XXX
180K "	2	R138, R141	0062-287B3-1XXX
510K II	4	R144, R145, R149, R150	0062-313B3-1XXX
1 MEG II	2	R152, R154	0062-323B3-1XXX
820 OHM 6 PIN SIP	1	RM8	0886-00805-0800
1.8 K 10 PIN SIP	1	RM9	0886-00805-0600
2.7 K 10 PIN SIP	2	RM4 RM5	0886-00805-0500
4.7 K 8 PIN SIP	1	RM7	0886-00805-0400
4.7 K 10 PIN SIP	2	RM1, RM14	0886-00805-0300
1N4148	6	D101 D103, D105-D107	0886-00801-0200
2N4403	1	Q104	0886-00802-0500
TIP 110	3	Q101-Q103	0886-00802-0400
74LS02	1	D8	0886-00803-7400
74LS04	1	C11	0886-00803-6900
74S04	1	F12	0886-00803-6600
7406	1	A1	0886-00803-7600
7407	1	C6	0886-00803-5900
74LS08	1	A13	0886-00803-7300
7427	1	C13	0886-00803-7200
74LS32	1	B10	0886-00803-6100
7474	1	F11	0886-00803-6700
74126	1	E12	0886-00803-6800
74LS138	4	B12-B13, B7-B8	0886-00803-6500
74160	1	D11	0886-00803-5200
74181	1	E11	0886-00808-5100
74166	1	D13	0886-00803-5300
74LS174	1	B14	0886-00803-7500
74LS191	6	F3-F5, F8-F10	0886-00803-5800
74LS244	3	94, E2, F2	0886-00803-4800
74LS245	1	A11	0886-00803-6400
74LS273	1	A4	0886-00803-4700
74LS367	1	C14	0886-00803-7000
74LS274	1	A5	0886-00803-4600
74LS870	2	B6, B11	0886-00803-6300
AY-3-8910	2	F6-F7	0886-00803-8500
LM3900	1	D3	0886-00803-4900
MC3403	2	C10, E10	0886-00803-5000
MC14016	1	D7-D9	0886-00803-6200
MC14024	1	C12	0886-00803-7100
PROM SB2-A	1	D12	0886-00803-6200
RAM 1K X 8 SUB	1	A6	0886-00803-6000
ROM/FROM O	1	A7	
II 1	1	A8	
II 2	1	A9	
II 3	1	A10	
Z 80 (3860)	1	A12	0886-00803-5500
16 PIN IC SOCKET	1	ICSD12	0886-00804-1400
24 P/N II II	5	ICSA6-ICSA10	0886-00804-1600
40 PIN II II	3	ICSA12, ICSF6 ICSF7	0886-00804-1500
3 PIN KK-100 RT ANGEL	1	J3	3000-15366-0300
4 PIN II II	1	J5	3000-16366-2400
5 PIN II II	2	J3, J4	3000-16366-0500
13 PIN II II	1	J4	3000-16366-1300
18 PIN II II	1	J5	3000-16366-1800
4 PIN CONN KK-100 (SIP)	2	J1, J2	0886-00804-1300
20 PIN " II	2	J1, J2	0886-00804-1200
JUMPER WIRE	2	JW1, JW2	0886-00804-4000
YELLOW LED	1	LED 3	0886-00804-2000
SNAP'S	3	MHQD1 MHQD3	0017-00007-0134
8 POSITION DIP SW	1	SW3	0886-00805-0900
10 POSITION DIP SW	1	SW1	0886-00805-1000
P.B SW	1	SW4	0886-00804-1700
16 MHZ CRYSTAL WARD LEAD	1	XTAL	0886-00805-1100

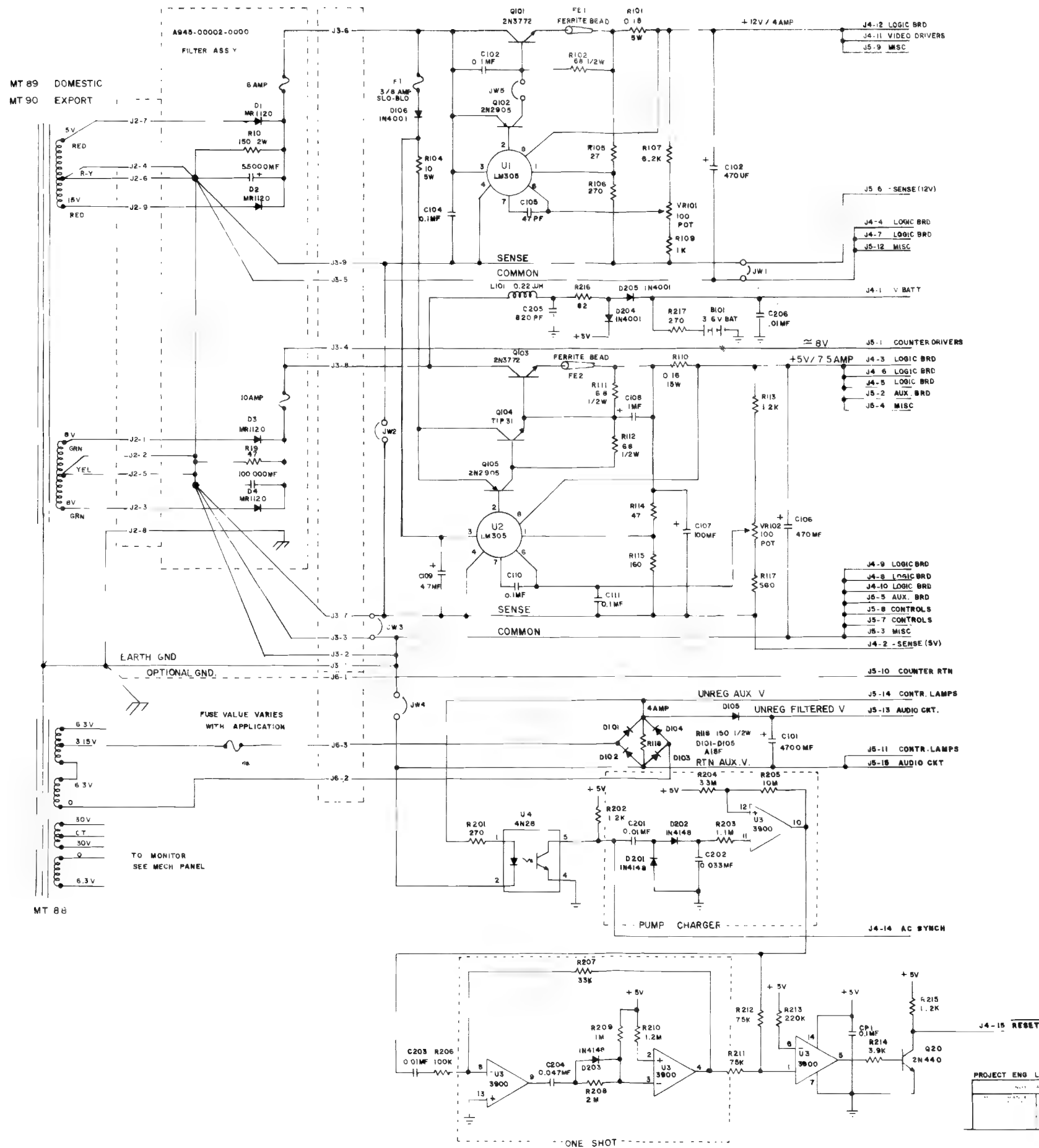
DESIGNATION LIST

DESIGNATION	DESCRIPTION	DESIGNATION	DESCRIPTION
C101, C103	10 MF 25V AX TANT	D101, D103, D105, 107	1N4148
C112, C127	1 MF 80V AX CER	D101, D101	TIP 110
C128, C129	47 PF 50V AX CER	Q104	2N4401
C130	220 PF " " "		
C131	10 MF 25V AX TANT	" 1A	1401
C134, C137	1 MF 20V AX TANT	" 4A	24LS273
C138	10 MF 25V AX TANT	" 5A	74LS374
C139	047 MF 100V MYLAR	" 4A	1Kx8 RAM
C140, C141	01 MF 50V AX CER	" 7A	ROM/EPROM
C142	100 PF 50V AX CER	" 8A	" " 1
C143	1 MF 80V AX CER	" 9A	" " 2
C144	13 PF 50V AX CER	" 10A	" " 3
C145, C156	6022 MF 100V 10% MYLAR	" 11A	74LS245
C157, C159	1 MF 20V AX TANT	" 12A	Z 80 CPU
C161	110 PF 50V AX CER	" 13A	74LS08
C162, C164	1 MF 20V AX TANT	" 4B	74LS244
C165	330 PF 50V AX CER	" 7B	74LS138
C166, C168, C172	10 MF 25V AX TANT	" 8B	"
C173	01 MF 50V AX CER	" 9D	74LS670
CP1	470 MF 16V AX ELECT	" 10B	74LS32
CP2, CP12	01 MF 50V AX CER	" 11B	74LS610
CP 3	470 MF 16V AX ELECT	" 12B	74LS138
CP14, CP33	01 MF 50V AX CER	" 13B	"
CP14	10 MF 25V AX TANT	" 14B	74LS174
CP15, CP46	01 MF 50V AX CER	" 15C	740
CP47	470 MF 16V AX ELECT	" 16C	MC1403
CP48, CP51	01 MF 50V AX CER	" 17C	74LS04
CP52, CP53	10 MF 25V AX TANT	" 18C	MC14024
CP44	470 MF 16V AX ELECT	" 19C	74LS147
CP201, CP204	01 MF 25V AX TANT	" 14C	74LS367
		" 1D	14LS1001
R101, R107	4.7 K 1/4W 5% CARBON	" 2D	74LS07
R116, R131	120 OHM " " "	" 3D	MC14013
R133	3.3 K " " "	" 4D	"
R138, R141	180 K " " " "	" 5D	"
R142	100 K " " " "	" 6D	"
R144, R145	510 K " " " "	" 11C	74160
R146	10 K " " " "	" 12D	PROM 512 A
R148	10 K " " " "	" 13D	74166
R149, R150	510 K " " " "	" 7L	74LS244
R151	10 K " " " "	" 13E	MC1403
R152	1 MEG " " " "	" 15	74LS1
R153	1 K " " " "	" 16	74LS26
R154	1 MEG " " " "	" 17	74LS244
R155, R156	10 K " " " "	" 18	74LS141
R157, R158	1.2 K " " " "	" 4E	"
R159, R161	110 OHM " " " "	" 5E	"
R162	120 OHM " " " "	" 6	AY 15110
R163	1.2 K " " " "	" 7E	"
R164	22 OHM " " " "	" 8	74LS191
R165, R166	4.7 K " " " "	" 9E	"
R173, R178	5.6 K " " " "	" 10E	"
R179, R186	24 K " " " "	" 11E	7474
R197, R202	5.6K " " " "	" 12E	74S04
R203, R208	33 K " " " "	ICS 1A=ICS 10A	J4 PIN IC SOCKET
R209, R211	18 K " " " "	" 1A	40 PIN "
R213	27K " " " "	" 12D	5 PIN K 100 BT AT
R214, R216	33K " " " "	" 13	1 PIN " "
R220, R222	18 K " " " "	" 14	13 PIN " "
R224	27K " " " "	" 5	13 PIN " "
R225, R226	4.7K " " " "	" 15	4 PIN " "
R227	1 K " " " "	J1, J2	20 PIN CONN KK 100
R228	4.7 " " " "	J3	4 PIN " "
R231	300 OHM " " " "	"	5 PIN K 100 BT AT
R232	4.7K " " " "	J4	1 PIN " "
R233	3K " " " "	"	5 PIN " "
R234, R236	4.7K " " " "	"	13 PIN " "
R239	100 OHM " " " "	"	13 PIN " "
R301, R306	2.7K " " " "	"	4 PIN " "
R401	1 K " " " "	HW1, HW2	AMP/PER JIRE
R402, R408	4.7K " " " "	LED 1	110V LED
SW1	4.7K 10 PIN DIP	SW1	10 POSITION DIP
SW4, R405	2.7K " " " "	SW1	8 " "
R407	4.7K " " " "	SW4	PUSH BUTTON SW
SW8	820 OHM " " " "	XTAL 1	16 MHz CRYSTAL
R408	1.8K 10 " " "		
R414	4.7K " " " "	HW101, HW102	CAP



W/O PANNING KIT

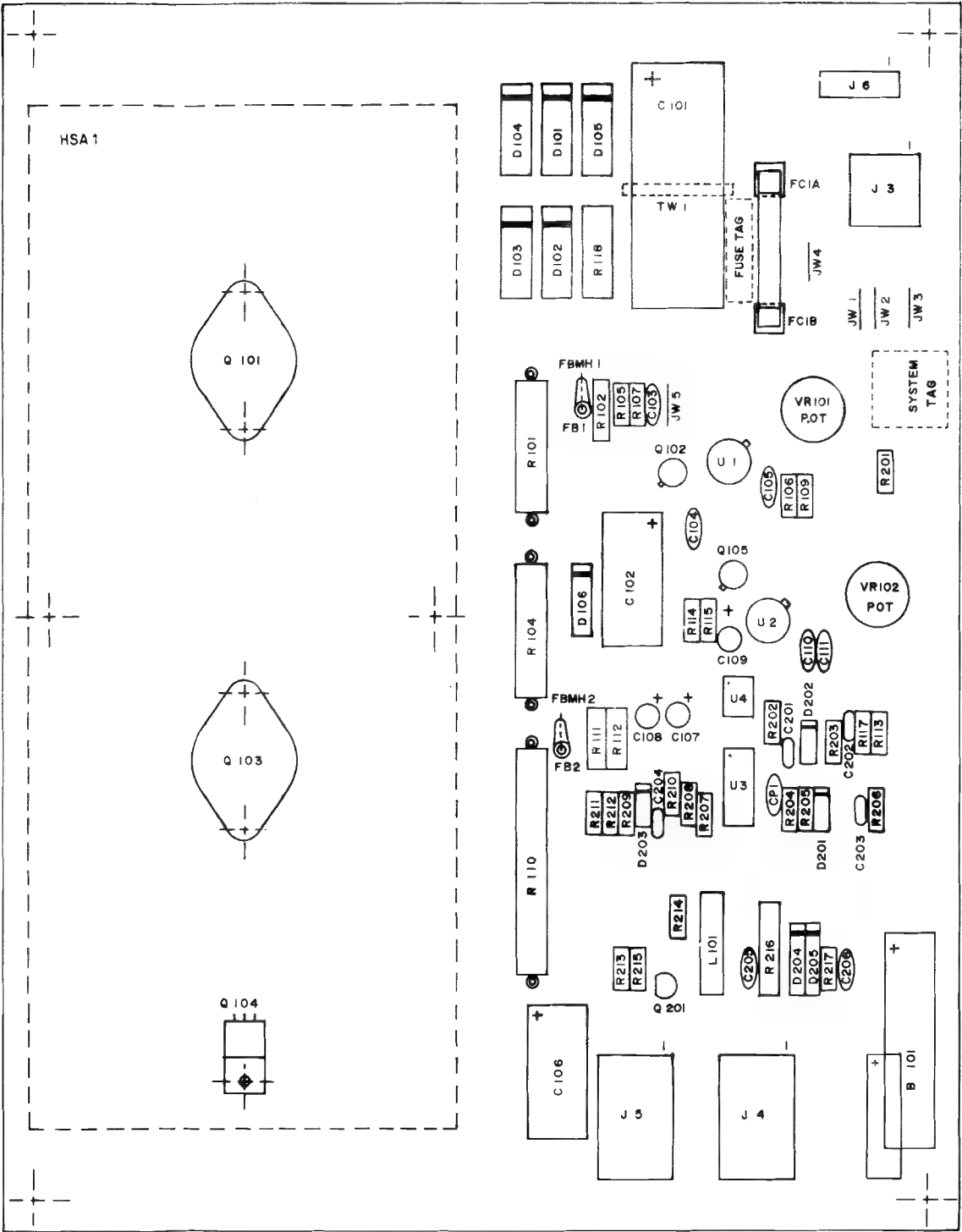
DESIGNATION LIST		CROSS REFERENCE LIST			
DESIGNATION	DESCRIPTION	DESCRIPTION	QTY	DESIGNATION	PART NO.
R403, R404	33K OHM 1/4w CRBN	33 K OHM 1/4w CRBN	2	R403 R404	0062-251B3-1XXX



PROJECT ENG L DEKKER		SOLARFOX		MIDWAY MFG. CO.	
DATE		1 PER		DATE	
6-11-82		SCHEMATIC DRAWING		M051-00945-8007	
		128VA POWER SUPPLY			
		A082-90412-8000			

DESIGNATION LIST

DESIGNATION #	DESCRIPTION	DESIGNATION #	DESCRIPTION
C101	4700uf AX. ELECT.	Q102	2N2905
C102	470uf AX. ELECT.	Q105	2N2905
C103	.1uf AX. CER.	Q201	2N4401
C104	.1uf AX. CER.		
C105	47pf AX. CER.		
C106	470uf AX. ELECT.		
C107	100uf RD. TANT.		
C108	1uf RD. TANT.	U1	LM305 REG.
C109	4.7uf RD. TANT.	U2	LM305 REG.
C110	.1uf AX. CER.	U3	LM3900
C111	.1uf AX. CER.	U4	4N28
C201	.01uf MYLAR	L101	.22uH INDUCTOR
C202	.033uf MYLAR	B101	BATTERY 3.6VDC 60DEG-C
C203	.01uf MYLAR	F1	3/8A S-BLO FUSE
C204	.047uf MYLAR	FC1A,1B	FUSE CLIP
C205	820pf AX. CER.	FE1,2	FERRITE BEAD
C206	.01uf AX. CER.	TW1	TIE WRAP
CP1	.1uf AX. CER.	J3	9PIN P.C. MOUNT CONN.(MALE)
		J4	15PIN P.C. MOUNT CONN.(FEMALE)
		J5	15PIN P.C. MOUNT CONN.(MALE)
		J6	3PIN P.C. MOUNT CONN.(MALE)
R101	.18ohm 5W W/RES. SPACER		
R102	68ohm 1/2W 5%		
R104	10ohm 5W W/RES. SPACER	LB1	FUSE TAG
R105	27ohm 1/4W 5%	LB2	SYSTEM TAG
R106	270ohm 1/4W 5%		
R107	6.2K 1/4W 5%		
R109	1K 1/4W 5%	HSA1	HEAT SINK ASS'Y 1
R110	.16ohm 15W W/RES. SPACER	MHSA1	MOUNTING HARD WARE(HEAT SINK)
R111	6.8ohm 1/2W 5%		
R112	68ohm 1/2W 5%		
R113	1.2K 1/4W 5%		
R114	47ohm 1/4W 5%		
R115	160ohm 1/4W 5%		
R117	560ohm 1/4W 5%	JW1-5	JUMPER WIRE
R118	150ohm 2W	FBMH1,2	FERRITE BEAD MOUNTING HARDWARE
R201	270ohm 1/4W 5%		
R202	1.2K 1/4W 5%		
R203	1.1M 1/4W 5%		
R204	3.3M 1/4W 5%		
R205	10M 1/4W 5%		
R206	100K 1/4W 5%		
R207	33K 1/4W 5%		
R208	2M 1/4W 5%		
R209	1M 1/4W 5%		
R210	1.2M 1/4W 5%		
R211	75K 1/4W 5%		
R212	75K 1/4W 5%		
R213	220K 1/4W 5%		
R214	3.9K 1/4W 5%		
R215	1.2K 1/4W 5%		
R216	82ohm 1W 10%		
R217	270ohm 1/4W 5%		
VR101,102	100ohm POT		
D101	A15F		
D102	A15F		
D103	A15F		
D104	A15F		
D105	A15F		
D106	1N4001		
D201	1N4148		
D202	1N4148		
D203	1N4148		
D204	1N4001		
D205	1N4001		



CROSS REFERENCE LIST

DESCRIPTION	Q'ty	DESIGNATION #	PART #
3PIN P.C. MOUNT CONN. (MALE)	1	J6	0017-00021-0443
9PIN P.C. MOUNT CONN.(MALE)	1	J3	0017-00021-0425
15PIN P.C. MOUNT CONN.(FEMALE)	1	J4	0017-00021-0441
15PIN P.C. MOUNT CONN.(MALE)	1	J5	0017-00021-0440
22AWG T&R BARE 2.5"	5	JW1-5	0151-00087-0000

PROJ. ENG : L. DEKKER

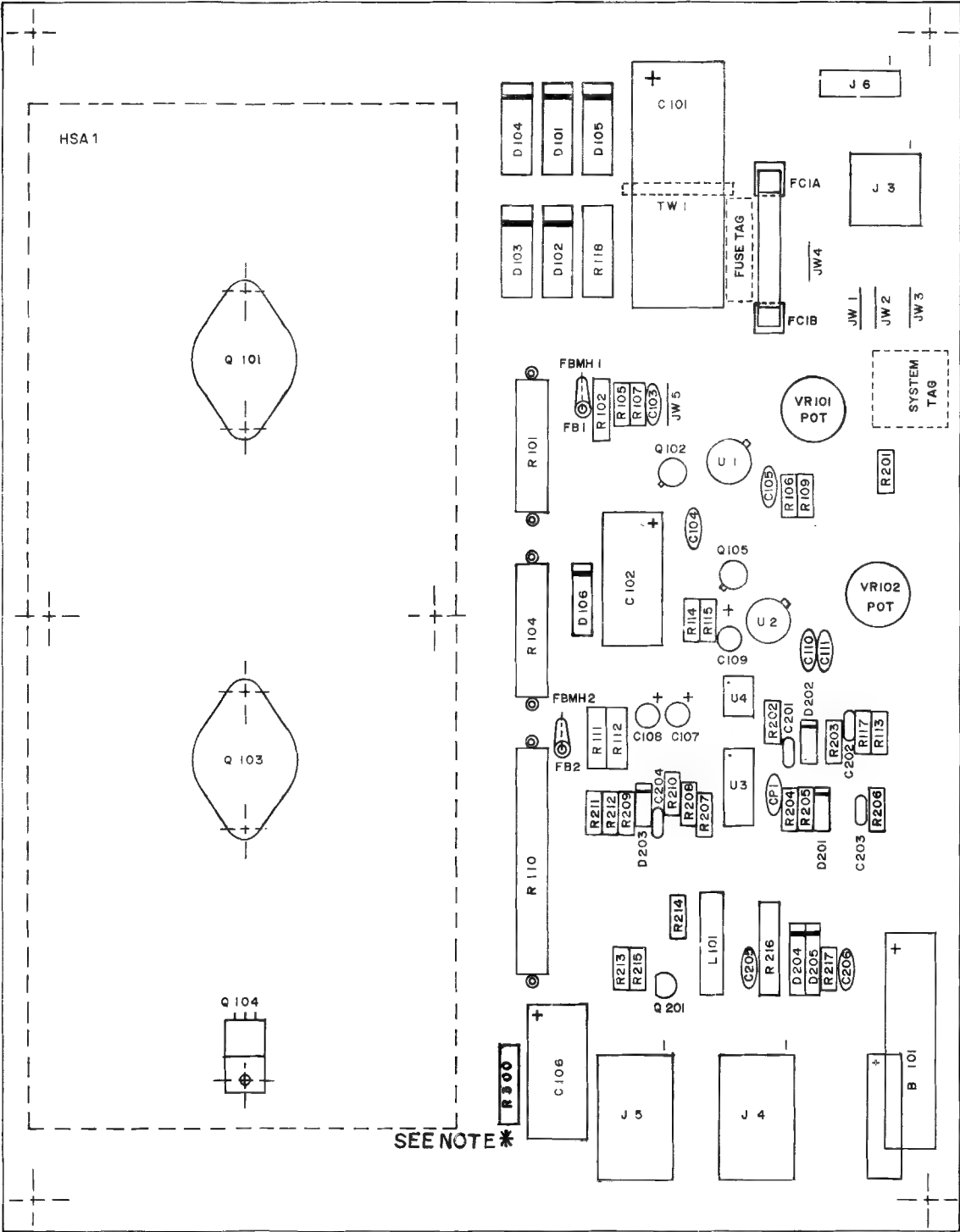
DO NOT SCALE DWG		HEAT TREAT	SCALE	USED ON SOLARFOX	REVISIONS	
DIM TOLERANCES UNLESS SPECIFIED		MAT L		NO REQ D 1PER	MIDWAY MFG. CO.	
DRN C.L.		FINISH		FRANKLIN PK ILL		
DATE 5-11-82		PWR SPLY 125VAW/CKT SPRT A082-90412-B000		PART NO M051-00945-B006		

CROSS REFERENCE LIST

DESCRIPTION	Q'ty	DESIGNATION #	PART #			
47pf AX. CER.	1	C105	0945-00811-0100	FERRITE BEAD	2	FB1,2 0017-00009-0225
820pf AX. CER.	1	C205	0945-00816-0400	FERRITE MOUNTING HDW.		
.01uf AX. CER.	1	C206	0945-00816-0100		2	FBMH1,2 0017-00033-0139
.01uf MYLAR	2	C201,203	0945-00816-0200	.22uH INDUCTOR	1	L101 0945-00814-0200
.033uf MYLAR	1	C202	0945-00816-0500	FUSE TAG	1	M051-00945-A004
.047uf MYLAR	1	C204	0945-00816-0300	SYSTEM TAG	1	M051-00945-A009
.1uf AX. CER.	5	C103,104,110,111, CP1	0945-00811-0200	P.C.B.	1	A080-90412-B000
1uf RAD. TANT	1	C108	0945-00811-0300			
4.7uf RAD. TANT	1	C109	0945-00811-0400	HEAT SINK ASS'Y	1	HSA1 A945-00008-0000
100uf RAD. TANT	1	C107	0945-00811-0500	(SEE HS ASS'Y DRAWING "XX NOTE")		
470uf AX. ELECT.	2	C102,106	0945-00816-0600	4-40 X 10 SLT RND	2	MH HSA 1A, 2A. 0017-00101-00727
470uf AX. ELECT.	1	C101	0945-00811-0700	4-40 HEX NUT	2	MH HSA 1E, 2E. 0017-00103-0002
				WSH 4-120-.250-018	4	MH HSA 1B, 1D 0017-00104-0071
						MH HSA 2B, 2D
.16ohm 15W 5%	1	R110	0945-00815-0100			
.18ohm 5W 5%	1	R101	0945-00815-0200			
6.8ohm 1/2W 5%	1	R111	0062-047D3-1XXX			
10ohm 5W 5%	1	R104	0945-00812-0100			
27ohm 1/4W 5%	1	R105	0062-068B3-1XXX			
47ohm 1/4W 5%	1	R114	0062-086B3-1XXX			
68ohm 1/2W 5%	2	R102,112	0062-098D3-1XXX			
82ohm 1W 10%	1	R216	0062-104F5-1XXX			
150ohm 2W 5%	1	R118	0945-00812-0200			
160ohm 1/4W 5%	1	R115	0062-124B3-1XXX			
270ohm 1/4W 5%	3	R106,201,217	0062-138B3-1XXX			
560ohm 1/4W 5%	1	R117	0062-162B3-1XXX			
1K 1/4W 5%	1	R109	0062-179B3-1XXX			
1.2K 1/4W 5%	3	R113,202,215	0062-183B3-1XXX			
3.9K 1/4W 5%	1	R214	0062-207B3-1XXX			
6.2K 1/4W 5%	1	R107	0062-217B3-1XXX			
33K 1/4W 5%	1	R207	0062-251B3-1XXX			
75K 1/4W 5%	2	R211,212	0062-269B3-1XXX			
100K 1/4W 5%	1	R206	0062-275B3-1XXX			
220K 1/4W 5%	1	R213	0062-291B3-1XXX			
1M 1/4W 5%	1	R209	0062-323B3-1XXX			
1.1M 1/4W 5%	1	R203	0062-325B3-1XXX			
1.2M 1/4W 5%	1	R210	0062-327B3-1XXX			
2M 1/4W 5%	1	R208	0062-337B3-1XXX			
3.3M 1/4W 5%	1	R204	0062-347B3-1XXX			
10M 1/4W 5%	1	R205	0062-371B3-1XXX			
100ohm POT	2	VR101,102	0945-00814-0000			
A15F RECTIFIER	5	D101-105	0945-00804-0200			
1N4001	3	D106,204,205	0945-00804-0300			
1N4148	3	D201-203	0945-00804-0500			
2N2905	2	Q102,105	0945-00808-0300			
2N4401	1	Q201	0945-00804-0400			
LM305 REG.	2	U1,2	0945-00813-0100			
LM3900	1	U3	0945-00813-0200			
4N28	1	U4	0945-00813-0300			
BATTERY 3.6VDC 60DEG-C	1	B101	0017-00003-0377			
FUSE 3/8A S-BLO	1	F1	0945-00808-0400			
FUSE CLIP	2	FC1A,1B	0017-00003-0214			
TIE WRAP	1	TW1	0945-00814-0300			

DESIGNATION LIST

DESIGNATION #	DESCRIPTION	DESIGNATION #	DESCRIPTION
C101	4700uf AX. ELECT.	Q102	2N2905
C102	470uf AX. ELECT.	Q105	2N2905
C103	.1uf AX. CER.	Q201	2N4401
C104	.1uf AX. CER.		
C105	47pf AX. CER.		
C106	470uf AX. ELECT.		
C107	100uf RD. TANT.		
C108	1uf RD. TANT.	U1	LM305 REG.
C109	4.7uf RD. TANT.	U2	LM305 REG.
C110	.1uf AX. CER.	U3	LM3900
C111	.1uf AX. CER.	U4	4N28
C201	.01uf MYLAR	L101	.22uH INDUCTOR
C202	.033uf MYLAR	B101	BATTERY 3.6VDC 60DEG-C
C203	.01uf MYLAR	F1	3/8A S-BLO FUSE
C204	.047uf MYLAR	FC1A,1B	FUSE CLIP
C205	820pf AX. CER.	FE1,2	FERRITE BEAD
C206	.01uf AX. CER.	TW1	TIE WRAP
CP1	.1uf AX. CER.	J3	9PIN P.C. MOUNT CONN.(MALE)
		J4	15PIN P.C. MOUNT CONN.(FEMALE)
		J5	15PIN P.C. MOUNT CONN.(MALE)
		J6	3PIN P.C. MOUNT CONN.(MALE)
R101	.18ohm 5W W/RES. SPACER		
R102	68ohm 1/2W 5%		
R104	10ohm 5W W/RES. SPACER		
R105	27ohm 1/4W 5%	LB1	FUSE TAG
R106	270ohm 1/4W 5%	LB2	SYSTEM TAG
R107	6.2K 1/4W 5%		
R109	1K 1/4W 5%	HSA1	HEAT SINK ASS'Y 1
R110	.16ohm 15W W/RES. SPACER	MHSA1	MOUNTING HARD WARE(HEAT SINK)
R111	6.8ohm 1/2W 5%		
R112	68ohm 1/2W 5%		
R113	1.2K 1/4W 5%		
R114	47ohm 1/4W 5%		
R115	160ohm 1/4W 5%		
R117	560ohm 1/4W 5%	JW1-5	JUMPER WIRE
R118	150ohm 2W	FBMH1,2	FERRITE BEAD MOUNTING HARDWARE
R201	270ohm 1/4W 5%		
R202	1.2K 1/4W 5%		
R203	1.1M 1/4W 5%		
R204	3.3M 1/4W 5%		
R205	10M 1/4W 5%		
R206	100K 1/4W 5%		
R207	33K 1/4W 5%		
R208	2M 1/4W 5%		
R209	1M 1/4W 5%		
R210	1.2M 1/4W 5%		
R211	75K 1/4W 5%		
R212	75K 1/4W 5%		
R213	220K 1/4W 5%		
R214	3.9K 1/4W 5%		
R215	1.2K 1/4W 5%		
R216	82ohm 1W 10%		
R217	270ohm 1/4W 5%		
R300	68ohm 1/2W 5%		
VR101,102	100ohm POT		
D101	A15F		
D102	A15F		
D103	A15F		
D104	A15F		
D105	A15F		
D106	1N4001		
D201	1N4148		
D202	1N4148		
D203	1N4148		
D204	1N4001		
D205	1N4001		



CROSS REFERENCE LIST

DESCRIPTION	Q'ty	DESIGNATION #	PART #				
47pf AX. CER.	1	C105	0945-00811-0100	FERRITE BEAD	2	FB1,2	0017-00009-0225
820pf AX. CER.	1	C205	0945-00816-0400	FERRITE MOUNTING HDW.			
.01uf AX. CER.	1	C206	0945-00816-0100		2	FBMH1,2	0017-00033-0139
.01uf MYLAR	2	C201,203	0945-00816-0200	.22uH INDUCTOR	1	L101	0945-00814-0200
.033uf MYLAR	1	C202	0945-00816-0500	FUSE TAG	1		M051-00945-A004
.047uf MYLAR	1	C204	0945-00816-0300	SYSTEM TAG	1		M051-00945-A009
.1uf AX. CER.	5	C103,104,110,111, CP1	0945-00811-0200	P.C.B.	1		A080-90412-B000
1uf RAD. TANT	1	C108	0945-00811-0300				
4.7uf RAD. TANT	1	C109	0945-00811-0400	HEAT SINK ASS'Y	1	HSA1	A945-00008-0000
100uf RAD. TANT	1	C107	0945-00811-0500	(SEE HS ASS'Y DRAWING "XX NOTE")			
470uf AX. ELECT.	2	C102,106	0945-00816-0600	4-40 X 10 SLT RND	2	MH HSA1A,2A.	0017-00101-00727
470Cjf AX. ELECT.	1	C101	0945-00811-0700	4-40 HEX NUT	2	MH HSA1E,2E.	0017-00103-0002
				WSH 4-120-.250-018	4	MH HSA1B,1D	0017-00104-0071
						MH HSA2B,2D	
.16ohm 15W 5%	1	R110	0945-00815-0100				
.18ohm 5W 5%	1	R101	0945-00815-0200				
6.8ohm 1/2W 5%	1	R111	0062-047D3-1XXX				
10ohm 5W 5%	1	R104	0945-00812-0100				
27ohm 1/4W 5%	1	R105	0062-068B3-1XXX				
47ohm 1/4W 5%	1	R114	0062-086B3-1XXX				
68ohm 1/2W 5%	2	R102,112,300	0062-098D3-1XXX				
82ohm 1W 10%	1	R216	0062-104F5-1XXX				
150ohm 2W 5%	1	R118	0945-00812-0200				
160ohm 1/4W 5%	1	R115	0062-124B3-1XXX				
270ohm 1/4W 5%	3	R106,201,217.	0062-138B3-1XXX				
560ohm 1/4W 5%	1	R117	0062-162B3-1XXX				
1K 1/4W 5%	1	R109	0062-179B3-1XXX				
1.2K 1/4W 5%	3	R113,202,215	0062-183B3-1XXX				
3.9K 1/4W 5%	1	R214	0062-207B3-1XXX				
6.2K 1/4W 5%	1	R107	0062-217B3-1XXX				
33K 1/4W 5%	1	R207	0062-251B3-1XXX				
75K 1/4W 5%	2	R211,212	0062-269B3-1XXX				
100K 1/4W 5%	1	R206	0062-275B3-1XXX				
220K 1/4W 5%	1	R213	0062-291B3-1XXX				
1M 1/4W 5%	1	R209	0062-323B3-1XXX				
1.1M 1/4W 5%	1	R203	0062-325B3-1XXX				
1 2M 1/4W 5%	1	R210	0062-327B3-1XXX				
2M 1/4W 5%	1	R208	0062-337B3-1XXX				
3.3M 1/4W 5%	1	R204	0062-347B3-1XXX				
10M 1/4W 5%	1	R205	0062-371B3-1XXX				
100ohm POT	2	VR101,102	0945-00814-0000				
A15F RECTIFIER	5	D101-105	0945-00804-0200				
1N4001	3	D106,204,205	0945-00804-0300				
1N4148	3	D201-203	0945-00804-0500				
2N2905	2	Q102,105	0945-00808-0300				
2N4401	1	Q201	0945-00804-0400				
LM305 REG.	2	U1,2	0945-00813-0100				
LM3900	1	U3	0945-00813-0200				
4N28	1	U4	0945-00813-0300				
BATTERY 3.6VDC 60DEG-C	1	B101	0017-00003-0377				
FUSE 3/8A S-BLO	1	F1	0945-00808-0400				
FUSE CLIP	2	FC1A,1B	0017-00003-0214				
TIE WRAP	1	TW1	0945-00814-0300				

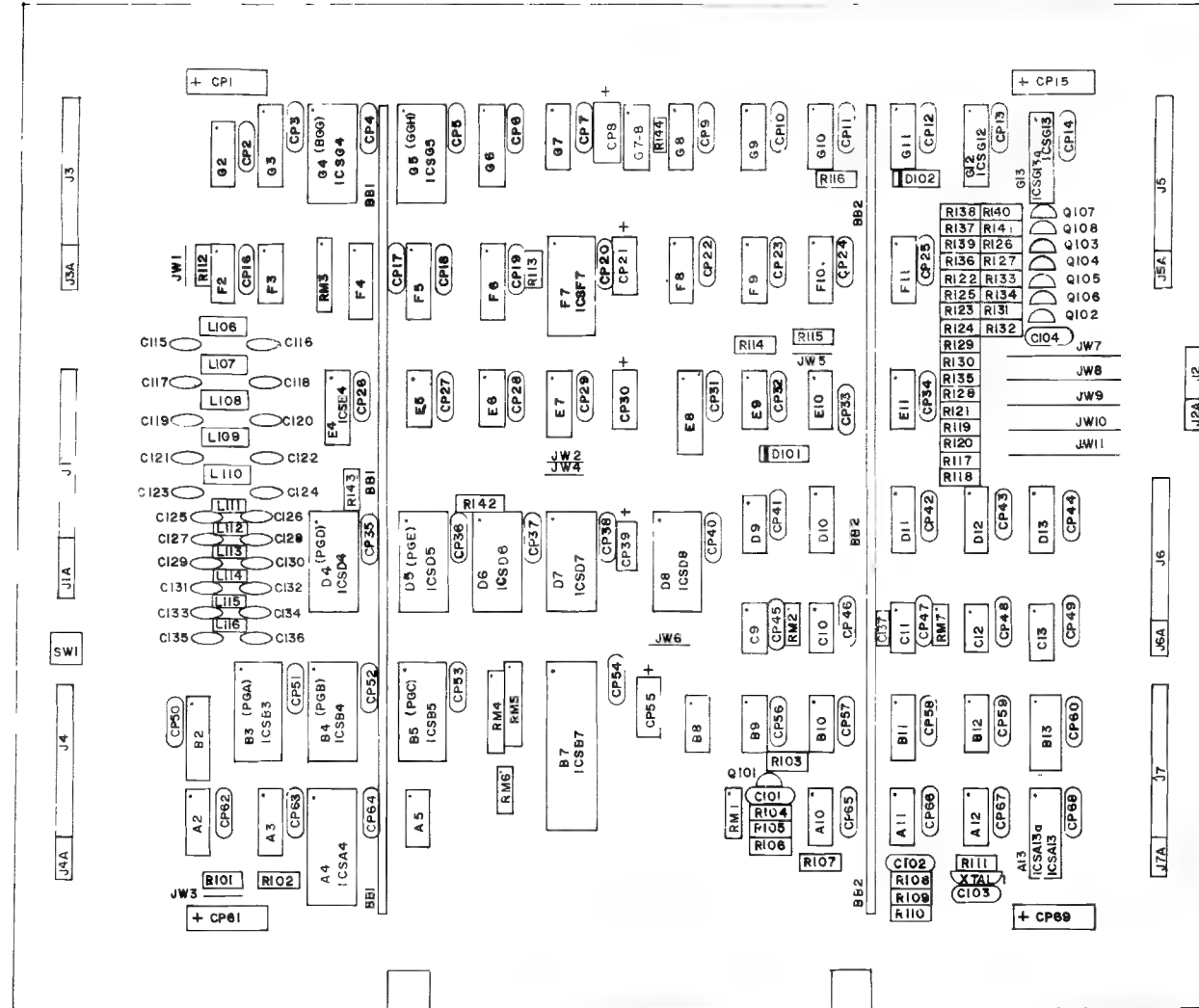
*NOTE: THIS RESISTOR MUST BE IN
CIRCUIT FOR PROPER OPERATION.

PROJ. ENG : L. DEKKER

DO NOT SCALE DWG		HEAT TREAT	SCALE	USED ON SOLARFOX	REVISIONS	
DIM TOLERANCES UNLESS SPECIFIED		DRN		NO REQ D 1PER	MIDWAY MFG. CO.	
UNLESS NOTED OTHERWISE		CHKD			FRANKLIN PK ILL	
DATE 6/11/82		MAT'L		PWR SPLY 125VAW/CKT SPRT	PART NO	
		FINISH		A082-90412-C000	M051-00945-C006	

DESIGNATION LIST

DESIGNATION	DESCRIPTION	DESIGNATION	DESCRIPTION	
C101	33 PF	50V AX. CER	IC C9	74LS08
C102	.1 MF	" "	" C10	7474
C103	1 MF	100V MYLAR	" C11	74S04
C104	390 PF	50V AX. CER	" C12,C13	74 20
C115-C137	01 MF	" "	" D4	EPROM
CPI	470 MF	16V ELECT. AX	" D5	EPROM
CP2-CP7	01 MF	50V AX. CER.	" D6	EPROM
CP8	10 MF	25V AX. TANT.	" D7	EPROM
CP9-CP14	.01 MF	50V AX. CER.	" D8	8415-20
CP15	470 MF	16V ELECT. AX.	" D9	74LS155
CP16-CP20	.01 MF	50V AX. CER.	" D10-D13	74LS157
CP21	10 MF	" "	" E4	NVR CONT
CP22-CP29	.01 MF	" "	" E5,E6	7432
CP30	10 MF	" "	" E7	74LS138
CP31-CP36	.01 MF	" "	" E8	74LS244
CP39	10 MF	" "	" E9	74 20
CP40-CP54	.01 MF	" "	" E10	74S04
CP55	10 MF	" "	" E11	7427
CP56-CP60	.01 MF	" "	" F2	4053
CP61	470 MF	16V ELECT. AX.	" F3	4017
CP62-CP68	.01 MF	50V AX. CER.	" F4,F5	74LS245
CP69	470 MF	16V ELECT. AX.	" F6	74LS374
			" F7	4801-AN-4
			" F8,F9	74LS157
			" F10,F11	7489
RI01, RI02	4.7 K	OHM 1/4W CRBN.	" G2	74LS153
RI03	560	" "	" G3	74LS374
RI04	1.2 K	" "	" G4	EPROM
RI05	220	" "	" G5	EPROM
RI06	22	" "	" G6	74LS374
RI07	4.7 K	" "	" G7	74LS153
RI08	330	" "	" G8 - G11	7489
RI09, RI10	1K	" "	" G12	MISC-T
RI11	330	" "	" G13	V-T
RI12	10K	" "	" G7-8	74LS174
RI13	1K	" "		
RI14, RI15	4.7 K	" "	L106-L110	10JH W.W.
RI16	1K	" "	L111-L116	10JH MOLD
RI17, RI18	560	" "		
RI19	100	" "	ICSA4	28 PIN IC SOCKET
RI20	820	" "	ICSA13	16 " " "
RI21	130	" "	ICSA13a	8 " " "
RI22	2K	" "	ICSB3-ICSB5	24 " " "
RI23	1K	" "	ICSB7	40 " " "
RI24	470	" "	ICSB13	20 " " "
RI25	240	" "	ICSD4-ICSD8	24 " " "
RI26, RI27	10	" "	ICSF7	24 " " "
RI28	130	" "	ICSG4, ICSG5	24 " " "
RI29	2K	" "	ICSG12	20 " " "
RI30	1K	" "	ICSG13	16 " " "
RI31	470	" "	ICSG13a	8 " " "
RI32	240	" "	ICSE4	20 " " "
RI33, RI34	10	" "	BB1, BB2	BUS BAR
RI35	130	" "	S.W.	SWITCH P.B. MTG
RI36	2K	" "	XTAL1	19.968 MHZ CRYSTAL
RI37	1K	" "	JW1- JW11	JUMPER WIRE
RI38	470	" "	J1A	KK-156 STR. 5 PIN
RI39	240	" "	J1	" " " 14 PIN
RI40, RI41	10	" "	J2A	KK-100 RT ANGLE 2PIN
RI42, RI43	4.7 K	" "	J2	" " " 6PIN
RI44	1K	" "	J3,J4,J5,J6 J7	" " " 24PIN
RM1	4.7 K	OHM 6 PIN SIP		
RM2	1K	" "		
RM3	4.7 K	" 9 " "		
RM4, RM5	10 K	" 10 " "		
RM6	10 K	" 8 " "		
RM7	560	" " " "		
D101	IN5817			
D102	IN4148			
Q101	2N4403			
Q102	2N4123			
Q103-Q108	MPSA70			
IC A2	74181			
" A3	74LS367			
" A4	MK3882			
" A5	74LS32			
" A10, A11	74S74			
" A12	74S04			
" A13	H-T			
" B2	74LS244			
" B3	EPROM			
" B4	EPROM			
" B5	EPROM			
" B7	MK3880			
" B8	7474			
" B9	7432			
" B10	74S04			
" B11	74LS367			
" B12	7432			
" B13	V8H-T			



PROJECT ENG: J. BOYDSTON.		USED ON SOLAR FOX		<div>REVISIONS</div> <div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> </div>	
DO NOT SCALE DWG		DATE		MIDWAY MFG. CO.	
DATE		FULL		FRANKLIN, KILL	
<div> <div>Q.M. TOLERANCE</div> <div>UNLESS SPECIFIED</div> <div> <div>FINISH</div> <div> <div>1/16" ±</div> <div>1/32" ±</div> <div>1/64" ±</div> </div> </div> </div>		<div> <div>DATE</div> <div> <div>11/11/82</div> <div>1/16/82</div> </div> </div>		<div> <div>PART NO</div> <div>MO51-00982 A005</div> </div>	
<div> <div>ASSEMBLY DRAWING</div> <div>CPU</div> <div>A082-90009-H000</div> </div>					

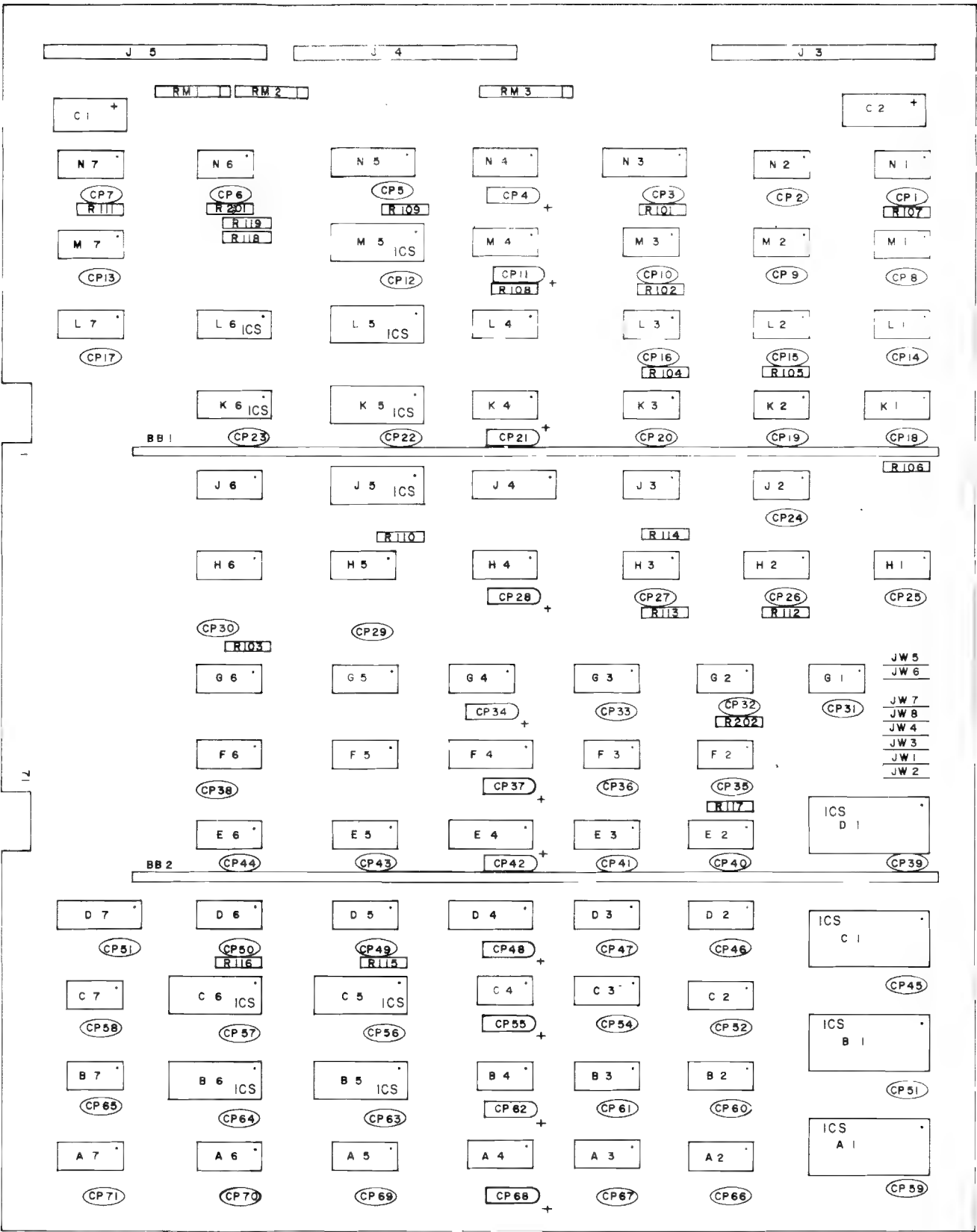
CROSS REFERENCE LIST

DESCRIPTION	QTY	DESIGNATION	PART NO.
33 PF 50V AX.CER	1	C101	0986-00800-0300
390 PF " " "	1	C104	0986-00800-3000
.01 MF " " "	83	CP2-CP7,CP9-CPI4, CPI6-CP20,CP22-CP29, CP31-CP38,CP40-CP54, CP56-CP60,CP62-CP68, CPII5-CPI36,C137	0986-00800-2200
.1 MF 100V MYLAR	1	C103	0986-00800-0100
.1 MF 50V AX.CER.	1	C102	0986-00800-0200
10MF 25V AX.TANT	5	CP8,CP21,CP30,CP39 CP55	0986-00800-3400
470MF 16V ELECT.	4	CPI,CPI5,CP61,CP69	0986-00800-3300
10 OHM 1/4W CRBN	6	R126,R127,R133,R134, R140,R141	0062-05183-1XXX
22 " " " "	1	R106	0062-06383-1XXX
100 " " " "	1	R119	0062-11083-1XXX
130 " " " "	3	R121,R128,R135	0062-11983-1XXX
220 " " " "	1	R105	0062-13383-1XXX
240 " " " "	3	R125,R132,R139	0062-13583-1XXX
330 " " " "	2	R108,R111	0062-14483-1XXX
470 " " " "	3	R124,R131,R138	0062-15683-1XXX
560 " " " "	3	R103,R117,R118	0062-16283-1XXX
820 " " " "	1	R120	0062-17483-1XXX
1K " " " "	5	R109,R113,R116,R123 R130,R137,R110,R144	0062-17983-1XXX
1.2K " " " "	1	R104	0062-18383-1XXX
2K " " " "	3	R122,R129,R136	0062-19383-1XXX
4.7K " " " "	7	R101,R102,R107,R114 R115,R142,R143	0062-21183-1XXX
10K " " " "	1	R112	0062-22783-1XXX
560 OHM 6 PIN SIP	1	RM7	0986-00804-2600
1K " " " "	1	RM2	0986-00804-2500
4.7K " 9 " " "	1	RM3	0986-00804-2200
4.7K " 6 " " "	1	RM1	0986-00804-2400
10K " " " "	1	RM6	0986-00804-2300
10K " 10 " " "	2	RM4,RM5	0986-00804-2700
1N4148	1	D102	0986-00801-0100
1N5817	1	D101	0986-00801-0300
MPSA70	6	Q103-Q108	0986-00802-0300
2N4123	1	Q102	0986-00802-0100
2N4403	1	Q101	0986-00802-0200
74S04	4	IC A12,B10,C11,E10	0986-00803-0400
74LS08	1	" C3	0986-00803-1600
7420	3	" C12,C13,E9	0986-00803-1200
7427	1	" E11	0986-00803-8800
7432	4	" B9,B12,E5,E6	0986-00803-0500
74LS32	2	" A5	0986-00803-0600
7474	2	" B8,C10	0986-00803-1400
74374	2	" A1C,A11	0986-00803-1500
7487	1	" F1Q,F11,G8,G9	0986-00803-1800
74LS138	1	" E7	0986-00803-1900
74LS153	2	" D2,D7	0986-00803-1000
74LS155	1	" D9	0986-00803-8600
74LS157	6	" D10-D13,F8,F9	0986-00803-1100
74161	1	" A2	0986-00803-0100
74LS174	1	" G7-E	0986-00803-9300
74LS244	2	" B2,E8	0986-00803-0800
74LS245	2	" F4,F5	0986-00803-0900
74LS367	2	" A3,B11	0986-00803-2200
74LS374	3	" F6,G3,G6	0986-00803-0700
MK3886	1	" B7	0986-00803-7800
MK3882	1	" A4	0986-00803-7700
4017	1	" F3	0986-00803-8700
4053	1	" F2	0986-00803-2000
4801-AN-4	1	" F7	0986-00803-8400
8416-20	1	" D8	0986-00803-8100
H-T	1	" A13	0986-00803-8900
V-T	1	" G13	0986-00803-9000
V8H-T	1	" B13	0986-00803-9100
MISC-T	1	" G12	0986-00803-9200
NVR CONT	1	" E4	0986-00803-3200
EPROM	1	" B3 (PGA)	OPTION KIT UPRIGHTS 0982-00803-0100
EPROM	1	" B4 (PGB)	
EPROM	1	" B5 (PGC)	
EPROM	1	" D4 (PGD)	
EPROM	1	" D5 (PGE)	
EPROM	1	" D6 (PGF)	OPTION KIT COCKTAILS, MINIS 0580-00803-1700
EPROM	1	" D7	
EPROM	1	" G4 (BGG)	
EPROM	1	" G5 (BGH)	
10UH W.W	5	L108-L110	0986-00804-0200
10UH MOLD	6	L111-L116	0986-00804-3300
19.963 MHZ CRYSTAL	1	XTAL1	0986-00804-0100

DESCRIPTION	QTY	DESIGNATION	PART NO.
8 PIN SOCKET	2	ICSA13a,ICSG13a	0986-00804-3600
16 " "	2	ICSA13,ICSG13	0986-00804-3700
20 " "	3	ICSB13,ICSG12,ICSE4	0986-00804-3800
24 " "	11	ICSB3-ICSB5, ICSD4-ICSD8, ICSF7,ICSG4,ICSG5	0986-00804-3400
28 " "	1	ICSA4	0986-00804-3900
40 " "	1	ICSB7	0986-00804-3500
BUS BAR	2	BB1,BB2	0986-00804-4100
SWITCH P.B. MTG.	1	SW1	0986-00804-3100
JUMPER WIRE	11	JW1-JW11	0986-00804-3200
KK100 RT ANGLE 2PIN	1	J2 A	0986-00804-4200
" " 6PIN	1	J2	0986-00804-4300
KK156 STR. 8PIN	1	J1A	0986-00804-4400
" " 14PIN	1	J1	
KK100RT ANGLE 24 PIN	5	J3-J7	0986-00804-4700
FLEX-PAC JUMPER	5	J3-J7	0986-00804-4800
CPU BD			A080-90009-H000

DESIGNATION LIST

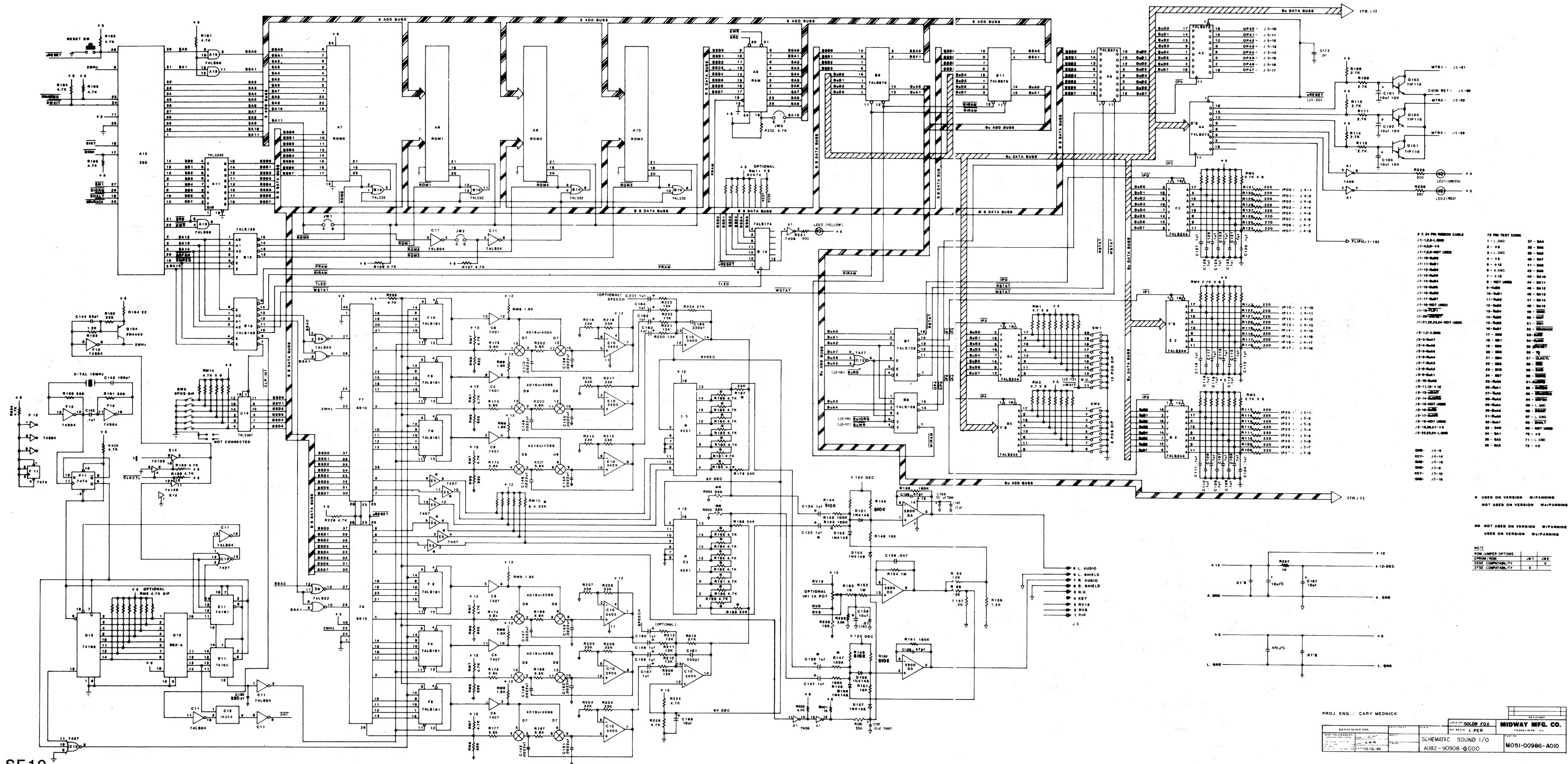
DESIGNATION	DESCRIPTION	DESIGNATION	DESCRIPTION	DESIGNATION	DESCRIPTION
C1, 2	100 μ f	IC A 1	EPROM	IC H 1	74LS86
	AX, ELECT	IC A 2	74LS157	IC H 2	74174
CP -3, 5-10	.0 μ f AX, CER.	IC A 3	74LS157	IC H 3	74S74
CP12-20, 22-27,		IC A 4	74LS157	IC H 4	74175
CP29-33, 35, 36,		IC A 5	74LS157	IC H 5	74174
CP38-41, 43-47,		IC A 6	74LS157	IC H 6	74LS157
CP49-54, 56-61,		C A 7	74LS157		
CP63-67, 69-71,					
CP4, 11, 21, 28, 34,	10 μ f 25V AX, TANT.	IC B 1	EPROM	IC J 2	74LS30
CP37, 42, 48, 55,		IC B 2	74LS194	IC J 3	7430
CP62, 68,		IC B 3	74LS194	IC J 4	74LS273
RI01-119, 201, 202,	1 K 1/4W 5%	IC B 4	74LS32	IC J 5	422
RM1, 2	8PIN 1 K SIP	IC B 5	422	IC J 6	74LS157
RM 3	10PIN 1 K SIP	IC B 6	422		
		IC B 7	74LS32		
		IC C 1	EPROM	IC K 1	74161
		IC C 2	74LS194	IC K 2	7430
		IC C 3	74LS194	IC K 3	7474
		IC C 4	74LS32	IC K 4	74161
		IC C 5	422	IC K 5	422
		IC C 6	422	IC K 6	2114-2
		IC C 7	74LS32		
		IC D 1	EPROM	IC L 1	74LS20
		IC D 2	74LS194	IC L 2	7408
		IC D 3	74LS194	IC L 3	7474
		IC D 4	74LS273	IC L 4	74LS283
		IC D 5	74LS157	IC L 5	422
		IC D 6	74LS157	IC L 6	2114-2
		IC D 7	74LS273	IC L 7	74LS157
		IC E 2	74LS194	IC M 1	7430
		IC E 3	74LS194	IC M 2	7432
		IC E 4	74LS374	IC M 3	74S74
		IC E 5	74LS157	IC M 4	74161
		IC E 6	74LS157	IC M 5	422
				IC M 7	74LS157
		IC F 2	7400	IC N 1	7430
		IC F 3	74S04	IC N 2	7427
		IC F 4	74LS374	IC N 3	74LS273
		IC F 5	74LS157	IC N 4	74LS283
		IC F 6	74LS157	IC N 5	74LS245
				IC N 6	7404
		IC G 1	74LS86	IC N 7	74LS157
		IC G 2	74LS20		
		IC G 3	74LS283		
		IC G 4	74LS283	ICS A1, B1, C1, D1,	28PIN IC SOCKET
		IC G 5	74LS283	ICS B5, 6, C5, 6,	22PIN IC SOCKET
		IC G 6	74LS157	J5, K5, L5, M5,	
				ICS K6, L6,	18PIN IC SOCKET
				J3, 4, 5,	24PIN SOCKET
				JW1-8	JUMPER WIRE
				BB1, 2	BUSS BAR

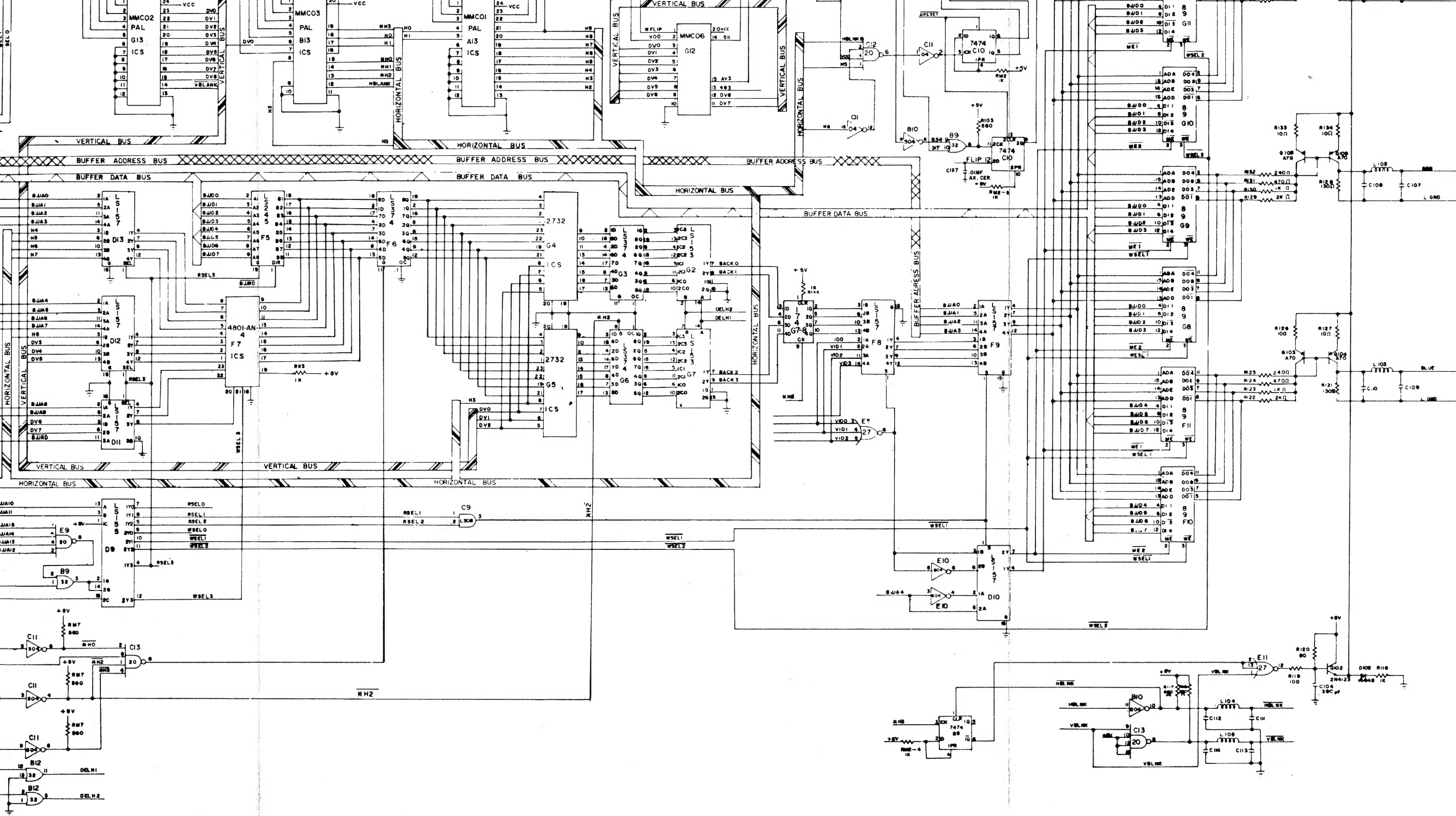
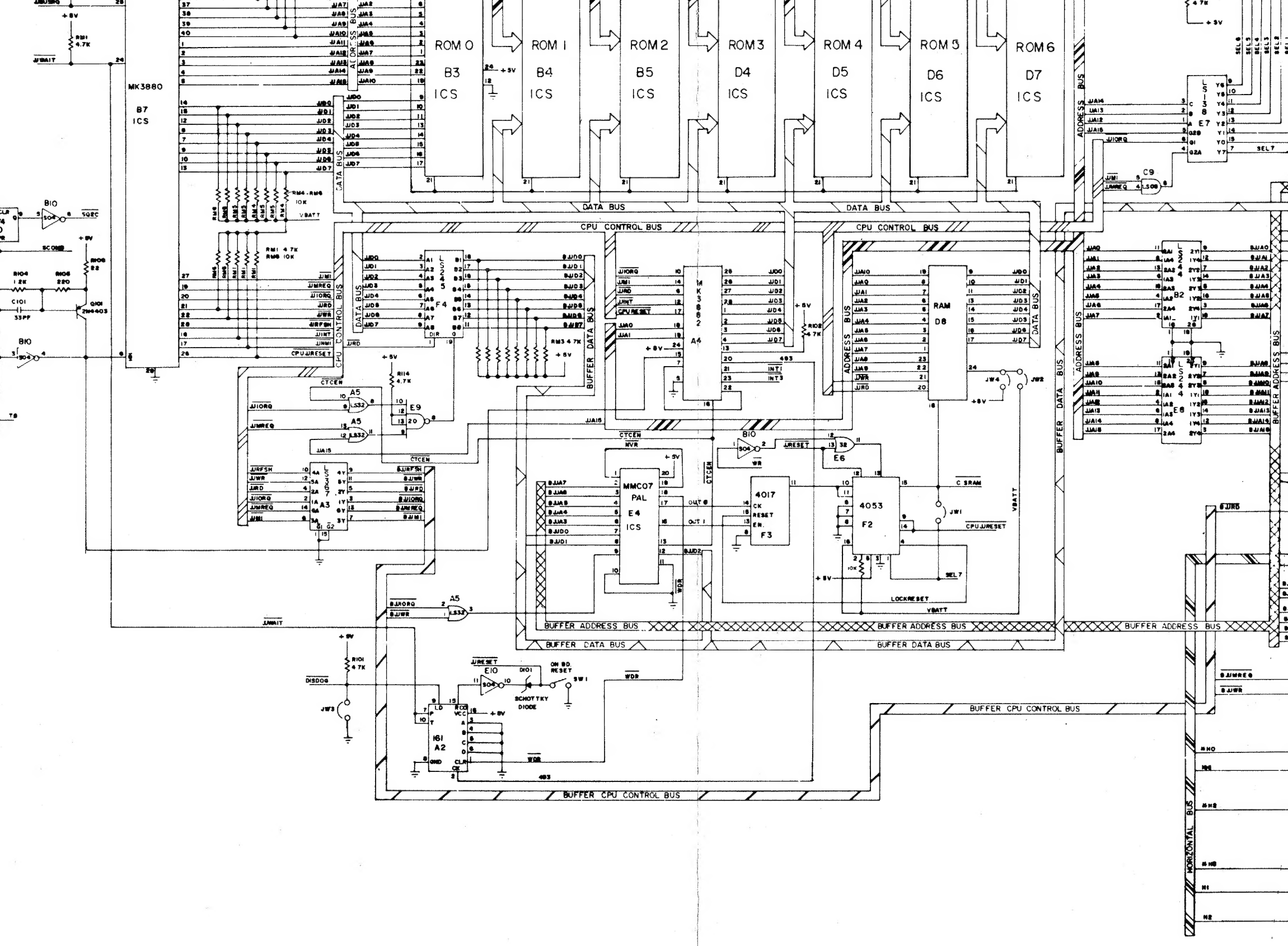
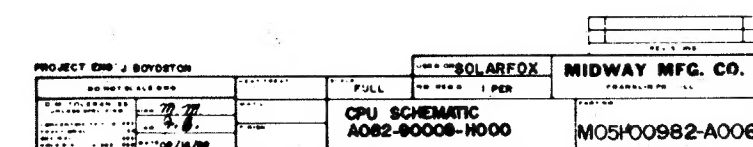


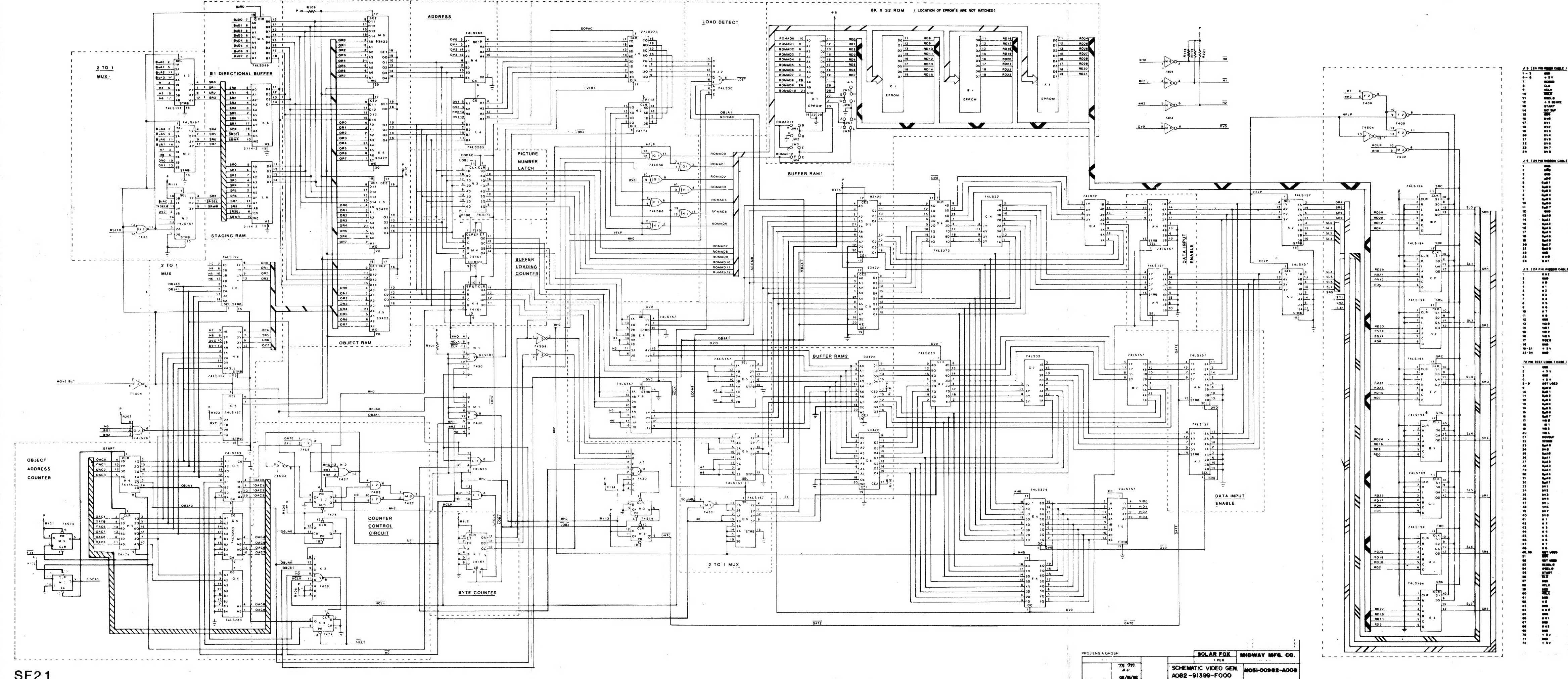
CROSS REFERENCE LIST

Q'TY	DESCRIPTION	DESIGNATION	PART NO.
60	.01 μ f 50V AX. CER.	CP1-3, CP5 10, CP12-20, CP22-27, CP29-33, CP35, 36, CP38-41, CP43-47, CP49-54, CP56-61, CP63-67, CP69-71.	0986 00800 2500
11	10 μ f 25 V AX. TANT.	CP4, 11, 21, 28, 34, 37, CP42, 48, 55, 62, 68.	0986-00800-2400
2	100 μ f 25 V AX. ELECT.	C1, 2.	0986-00800-1800
21	1 K 1/4 W CRBN. FLM.	R101-119, 201, 202.	0062-179B3-1XXX
2	1 K 8 PIN SIP	RM1, 2.	0986-00804-1100
1	1 K 10 PIN SIP	RM3	0986-00804-1000
2	2114-2	K6, L6.	0986-00803-2300
1	7400	F2	0986-00803-2800
1	7404	N6	0986-00803-8300
1	74S04	F3	0986-00803-3100
1	7408	L2	0986-00803-3200
2	74LS20	G2, L1	0986-00803-3400
1	7427	N2	0986-00803-3500
4	7430	J3, K2, M1, N1	0986-00803-3600
1	74LS30	J2	0986-00803-4300
1	7432	M2	0986-00803-4400
4	74LS32	B4, 7, C4, 7,	0986-00803-3700
2	7474	K3, L3	0986-00803-4500
2	74S74	H3, M3	0986-00803-4100
2	74LS86	G1, H1	0986-00803-4200
18	74LS157	A2, 3, 4, 5, 6, 7, D5, 6, E5, 6, F5, 6, G6, H6, J6, L7, M7, N7.	0986-00803-2400
3	74161	K1, K4, M4.	0986-00803-2500
2	74174	H2, 5	0986-00803-2600
1	74175	H4	0986-00803-2700
8	74LS194	B2, 3, C2, 3, D2, 3, E2, 3.	0986-00803-2900
1	74LS245	N5	0986-00803-3000
4	74LS273	D4, 7, J4, N3	0986-00803-3800
5	74LS283	G3, 4, 5, L4, N4,	0986-00803-3900
2	74LS374	E4, F4	0986-00803-4000
8	93422	B5, 6, C5, 6, J5, K5, L5, M5	0986-00804-0800
1	EPROM	A1 (VG A)	} OPTION KIT: COCKTAILS, MINIS 0580-00803-0100 OPT. KIT: UPRIGHTS 0982-00803-2000
1	EPROM	B1 (VG B)	
1	EPROM	C1 (VG C)	
1	EPROM	D1 (VG D)	
8	JUMPER WIRE	JW1-8	0986-00805-0200
2	BUSS BAR	BB1, 2	0986-00804-0900
1	P.C. BOARD		A080-91399-E000
3	24 PIN SOCKET	J3, 4, 5	0986-00804-4700
4	28 PIN SOCKET	ICSA1, B1, C1, D1	0986-00804-0300
8	22 PIN SOCKET	ICSB5, 6, C5, 6, J5, K5, L5, M5	0986-00804-0700
2	18 PIN SOCKET	ICS K6, L6	0986-00804-0600





SF20



SF2 1